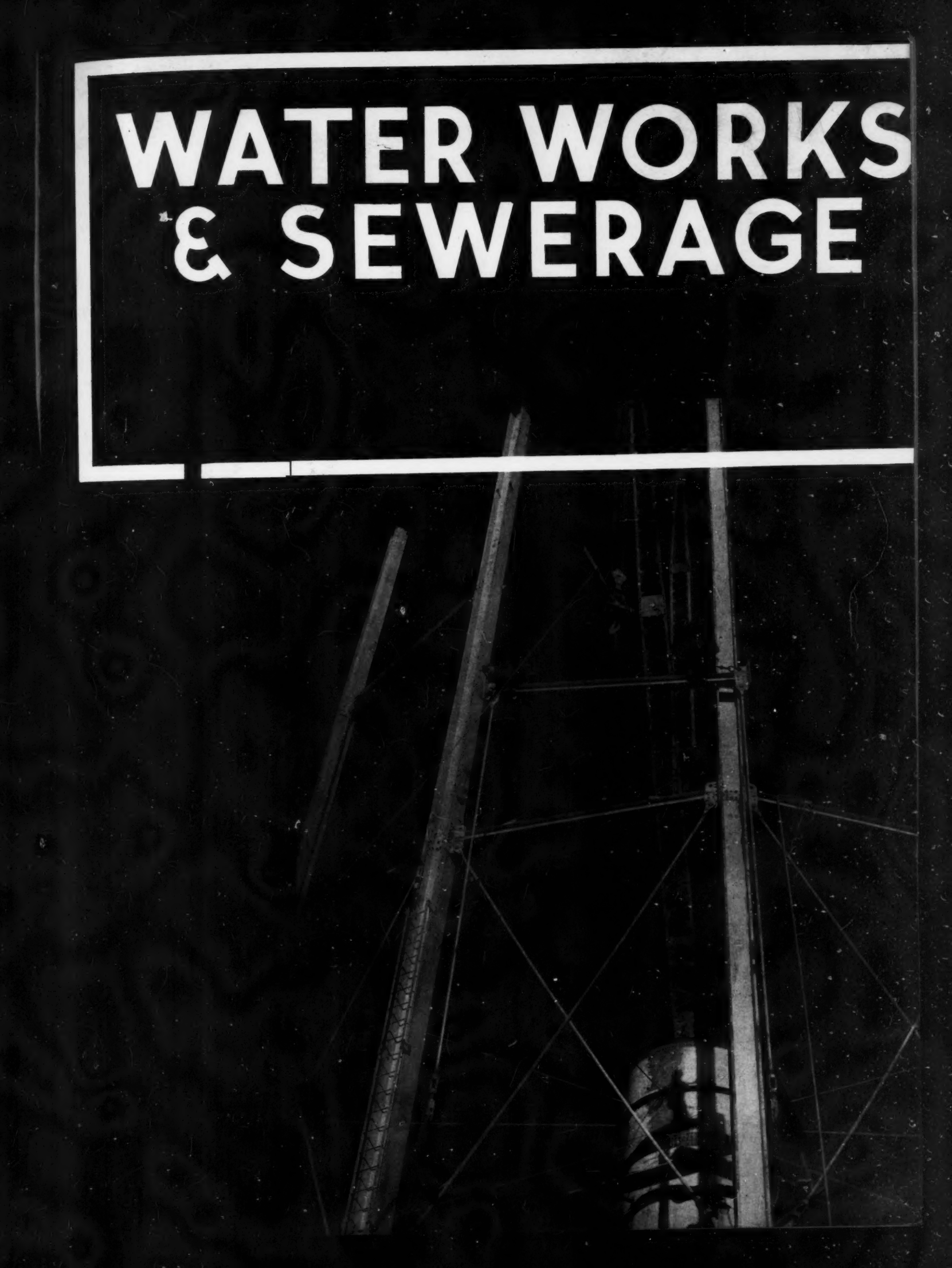
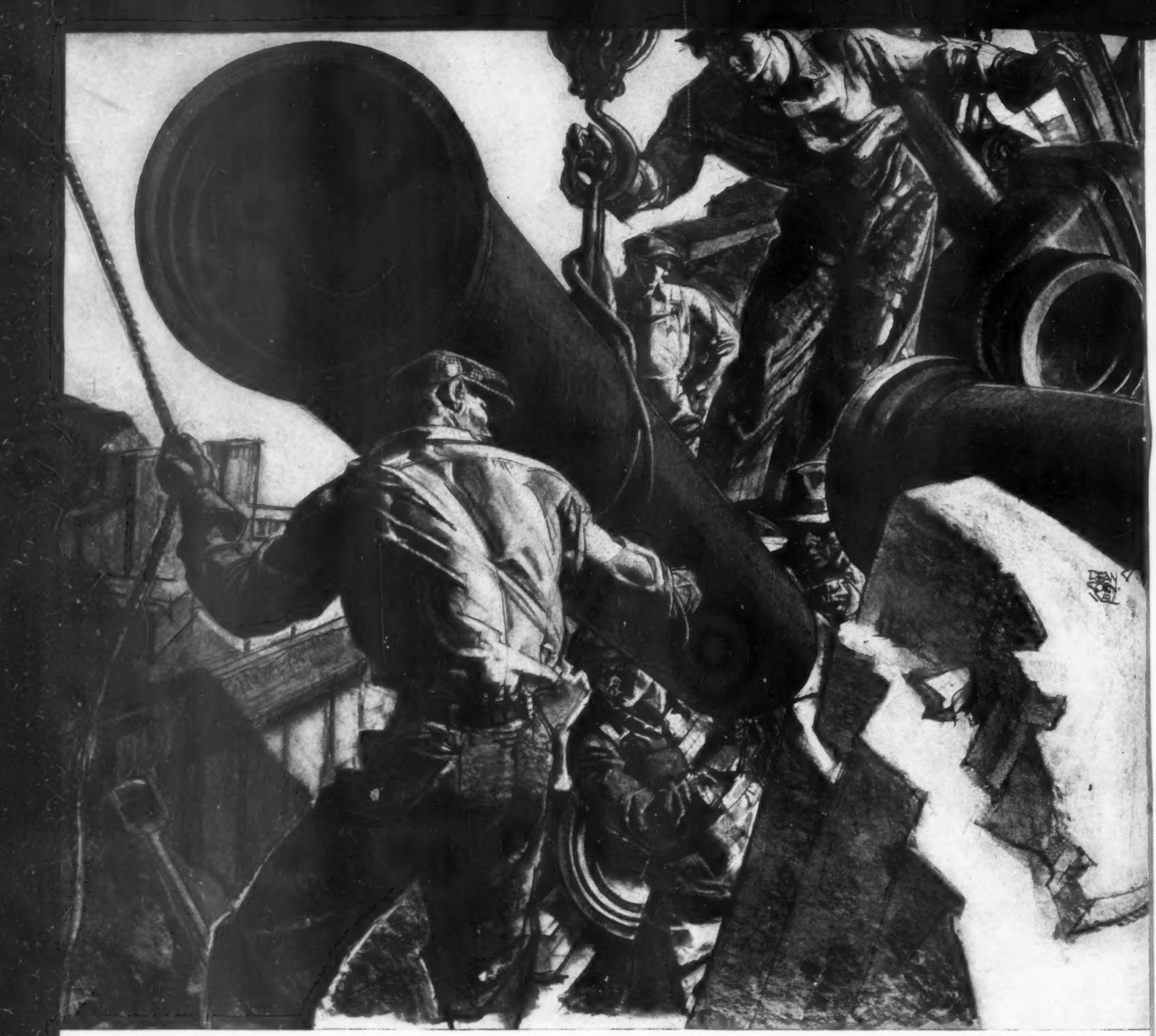
WATER WORKS & SEWERAGE





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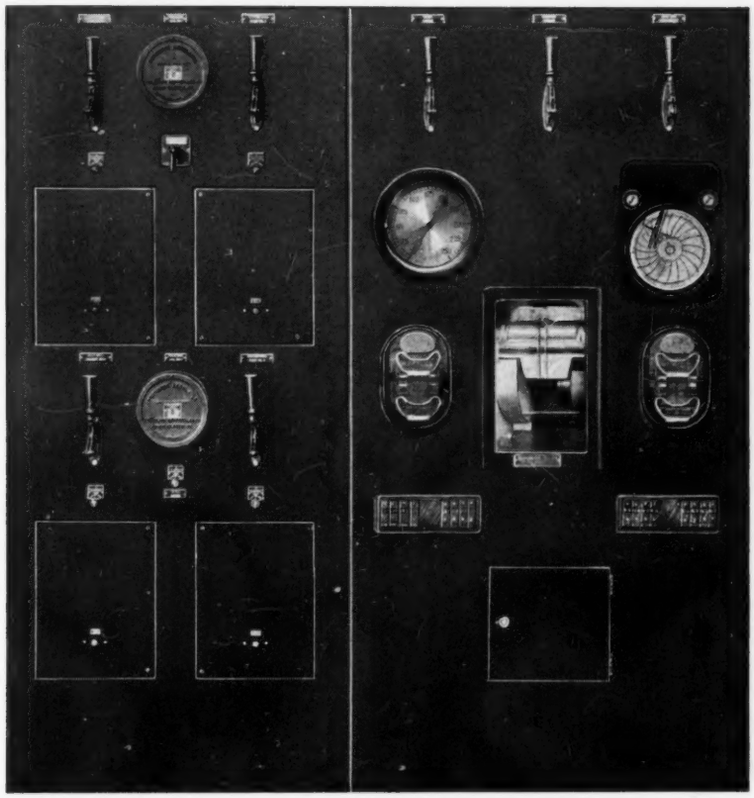

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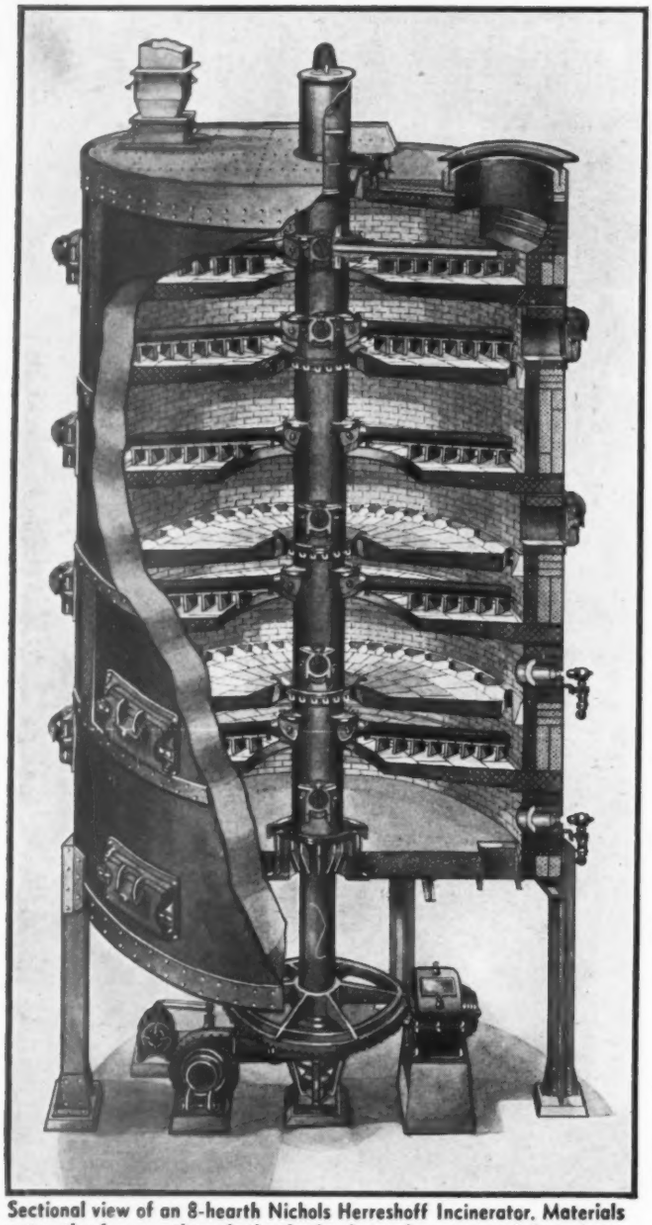
NICHOLS HERRESHOFF INCINERATORS DO A SANITARY, SAFE AND COMPLETE JOB OF DISPOSING OF SEWAGE SLUDGE, GRIT, etc.



Sectional view of an 8-hearth Nichols Herreshoff Incinerator. Materials enter the furnace through the feeder located on top at left and are directed through the drying and burning zone by the rabble arms, leaving the bottom hearth as sterile ash.

A Nichols Herreshoff multiple hearth incinerator completely — and in the most sanitary manner yet developed — quickly reduces sewage sludge, screenings, grit or garbage to odorless, sterile, inorganic ash.

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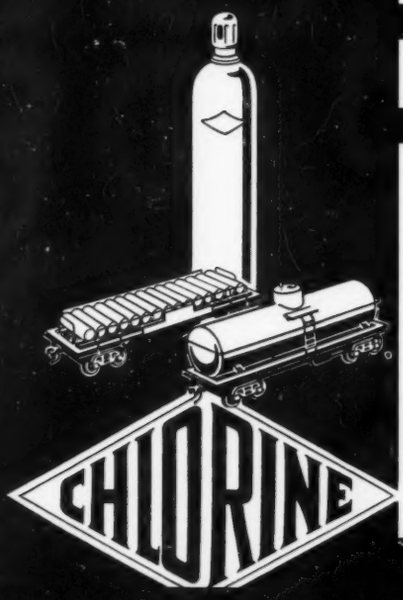

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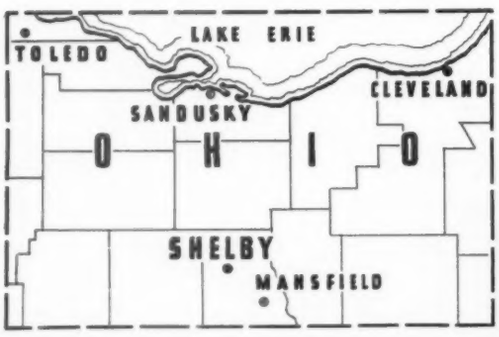
DISTINCTION in elevated storage tanks is not limited to just the very large installations. With a unit of 300,000-gal. capacity, engineers for Shelby, Ohio, succeeded admirably in securing for this community a tank that is attractive in appearance as well as efficient and dependable in operation.

As will be noted from the accompanying picture, one feature adding harmony to the design is the pleasing natural curves of the Horton ellipsoidal roof and bottom construction, giving the unit a streamlined appearance.

From an operating standpoint, equally satisfactory results are available. Water is supplied to some 7000 residents at uniform pressure and with ample reserve for fire protection service. We will appreciate an opportunity of conferring with waterworks engineers who are contemplating present or future storage facilities. Please address our nearest office.



The photograph at the right shows the 300,000-gal. Horton tank located at Shelby, Ohio. The map above shows the general location of Shelby with respect to surrounding cities.

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Chicago.....2198 Old Colony Bldg.
New York.....3390-165 Broadway Bldg.
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Dallas.....1479 Liberty Bank Bldg.
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Tulsa.....1646 Hunt Bldg.
Houston.....2919 Main Street
Detroit.....1551 Lafayette Bldg.
Philadelphia...1644-1700 Walnut St. Bldg.
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San Francisco.....1083 Rialto Bldg.
Los Angeles.....1455 Wm. Fox Bldg.

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TODAY THOSE VALVES ARE STILL IN SERVICE

46 YEARS OF TROUBLE-FREE SERVICE PROVES ECONOMY OF PREVENTIVE MAINTENANCE

IN 1893, Rochester, Indiana, boasted a municipal water works. Naturally the valves were carefully selected. Rochester chose Crane Valves. How wise this choice, was recently proved by the need of a new disc spreader pin for one of the valves. It was the first repair on these valves—after 46 years of trouble-free service.

And perhaps surprising, but certainly satisfying to the Rochester city management, was that Crane supplied the exact repair part within a few days—thus extending the life of the valve indefinitely.

It was Preventive Maintenance that Rochester applied in 1893. It counseled a choice of valves that were designed for a specific need—valves whose superior quality would give extra resistance to the strain of service conditions.

Today, to water works, filtration plants, and sewage systems, Crane offers complete assistance in applying Preventive Maintenance successfully. With a line of over 38,000 piping items representing the finest development in flow control equipment; with unmatched laboratory and plant facilities; and with vast experience in solving industry's piping problems, Crane can supply the *right* valve for every service. And there lies the secret of dependable, low-cost piping.

Your Crane Representative will gladly help you apply Preventive Maintenance. Ask him to demonstrate how it saves where ordinary maintenance wastes.

YOU'LL HAVE PEACE OF MIND WITH CRANE A. W. W. A. VALVES

With Crane 480½'s in your streets, you don't have to worry about valve troubles when it is necessary to shut off mains or distribution lines. As you turn the stems, they'll respond—smoothly and surely.

Crane No. 480½ double disc gate valves comply with the latest A.W.W.A. specifications in effect May 1, 1939. But in service in your lines, it's their Crane-Quality that counts. It's Crane laboratory control of raw materials that gives these valves extra strength to cope with stresses and strains—that gives seats and discs greater resistance to wear. It's Crane engineering in every part that assures lasting dependability at minimum expense.

For extension or modernization of water systems at lowest cost to taxpayers, Preventive Maintenance counsels Crane A. W. W. A. valves.

1940 our 85th YEAR

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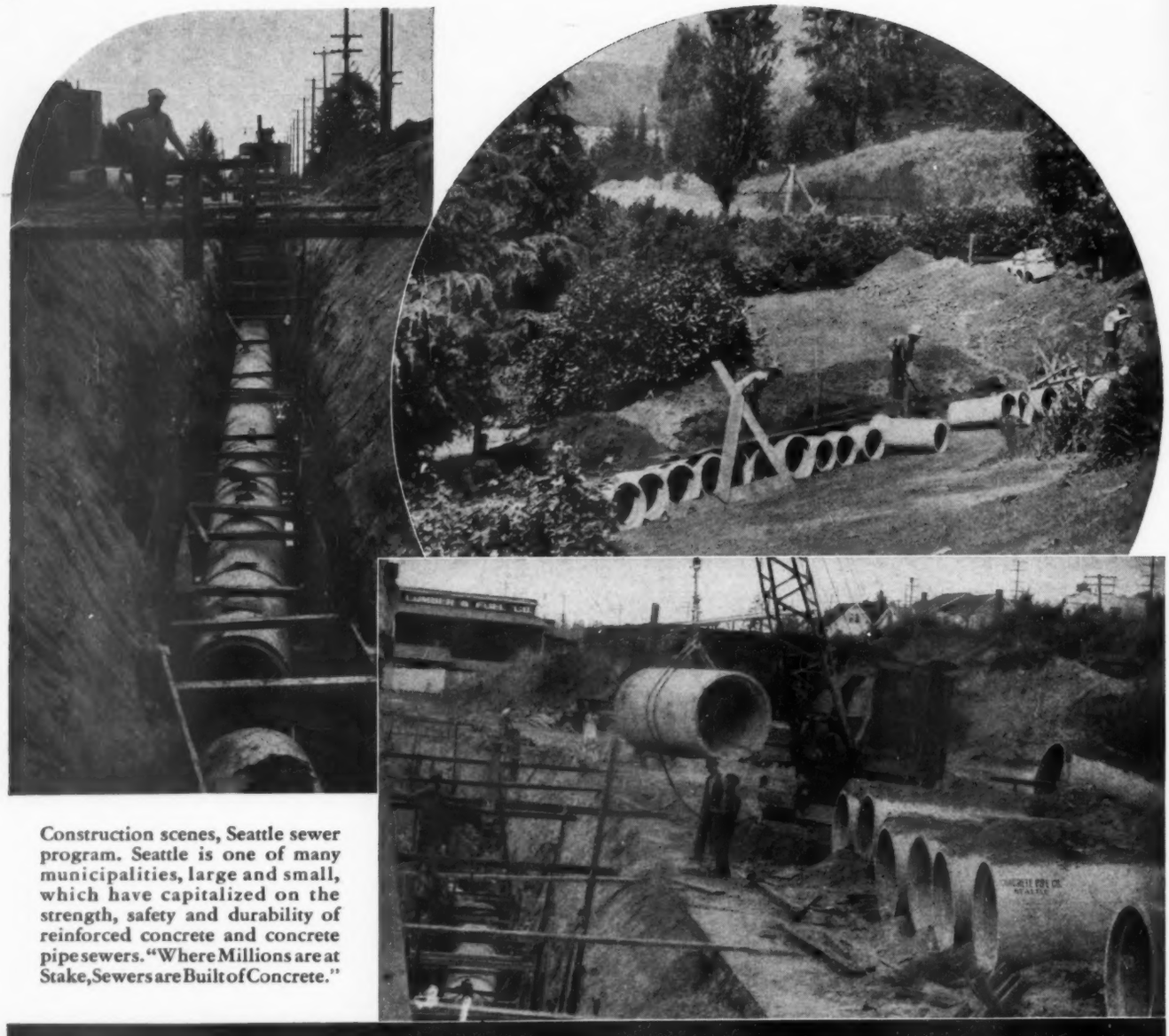

Construction scenes, Seattle sewer program. Seattle is one of many municipalities, large and small, which have capitalized on the strength, safety and durability of reinforced concrete and concrete pipe sewers. "Where Millions are at Stake, Sewers are Built of Concrete."

Seattle selects enduring CONCRETE for its $5,000,000 sewer projects

WITH 32 separate outfalls discharging into it, pollution of Seattle's beautiful Lake Washington became a serious danger. To solve the problem, a $5,000,000 network of trunk and intercepting sewers —*of concrete*—have been built or are now under construction.

A bond issue of $2,500,000 was voted in 1926. In 1928, $1,116,000 was used to build a 108-in. concrete sewer in tunnel discharging into Puget Sound. Construction was resumed in 1932 with an interceptor requiring 8,000 ft. of concrete pipe from 8 in. to 24 in. In 1934, with a PWA grant, interceptors costing $350,000 and using 18,945 ft. of 8-in. to 48-in. concrete pipe were constructed. A trunk sewer costing $700,000, requiring reinforced concrete pipe from 42 in. to 90 in. in diameter was partially constructed employing CWA and FERA labor. Later, a mile of 42-in. concrete pipe was placed with relief labor under WPA. A PWA project costing $230,000 and using 7,918 ft. of 8-in. to 72-in. concrete pipe was begun in January, 1935.

Three of the interceptors described above discharge into a 12-ft. concrete and brick sewer built in tunnel in 1910 which is in perfect condition today. To minimize leakage and infiltration, rigid tests of the completed sewer lines, including manholes, were required and met.

Concrete has demonstrated its adaptability, safety and economy in scores of important sewer projects. It is strong and durable; resists corrosion and requires little maintenance. Write for free literature covering all phases of sewer construction.

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● "Sanitation HTH" is the same dependable, convenient chlorine carrier that has been used successfully for years in water treatment all over the United States. But now it comes in granular form—just as quick and efficient as the old powder form, and more convenient to use. "It pours"—neatly, handily. This dry, free-flowing chlorine carrier, containing 70% available chlorine, is useful for every sort of water treating job—from sterilizing new water mains to disinfecting swimming pool water.

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THE MATHIESON ALKALI WORKS (INC.)

60 East 42nd Street, New York, N. Y.

What are the Facts about
LEAKAGE

Until recently the only known fact concerning leakage was that it is a part of unaccounted-for water. Water works authorities estimate that unaccounted-for water averages approximately 15% of normal consumption. The Cast Iron Pipe Research Association decided to find out what part of this 15% was due to leakage from mains.

* * * *

We have recently conducted a leakage test survey of cast iron mains in 25 cities in 6 states. The mains tested range from several hundred feet to more than twenty miles in length, in sizes from 4″ to 30″ and up to 44 years old, either with no service connections or relatively few that were turned off during the tests. The average leakage per mile of pipe, per inch of diameter, per 24 hours was 41 gallons—or an average of 380 gallons per mile of pipe per day for the sizes tested. This leakage is less than 2% of the average of normal consumption per mile of distribution main per day. This survey, covering a broad average of water main construction and substituting facts for guesswork, shows that

about nine-tenths of all unaccounted-for water* must be attributed to causes *other than leakage from cast iron water mains.

NORMAL CONSUMPTION OF WATER IS REPRESENTED BY 100%

100%

UNACCOUNTED-FOR WATER AVERAGES 15% OF NORMAL CONSUMPTION

15%

LEAKAGE FROM CAST IRON MAINS AVERAGED LESS THAN 2% OF TOTAL NORMAL CONSUMPTION

2%

For further information write to THE CAST IRON PIPE RESEARCH ASSOCIATION, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

CAST Q IRON

Look for the "Q-Check" registered mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.

WATER WORKS & SEWERAGE

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E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

Developments and Trends
In Sewerage and Sewage Treatment

Constitutes the annual review of progress in sewerage and sewage treatment to be featured in our February issue. Considering the many calls on the author's time, we feel particularly fortunate in getting—

DR. F. W. MOHLMAN, *Chief Chemist*
Sanitary District of Chicago

and Editor of "*Sewage Works Journal*," to undertake this assignment.

War Preparedness
In Respect to Water Supply and Sewerage

Is an interesting story of how British water and sewerage authorities have gone about protecting her water supply systems and sewerage facilities against aerial attacks and the drilling of employees for cool, and prompt action on the "water supply front" in restoring service.

JOHN S. TREVOR
Middlesex, England

Equipping
The Sewage Works Laboratory

Is the contribution of an engineer who has made a real study of the design and proper and necessary equippage of the sewage works laboratory. The author—

N. C. WITTWER, *Supervising Engr.*
Rahway Valley (N. J.) Joint Sewerage System

An Improved Scheme
of Handling Cast Iron Pipes

Is the subject of one of those pithy and helpful "Dear Tom" letters from one "Super" to another. The author—

D. R. TAYLOR, *Plant Sup't.*
Roanoke, Va.

GRIT—
Its Collection and Washing

The finest group of papers ever presented on the problem of grit separation from sewage, and its subsequent treatment and disposal, were the three given before one of those highly productive meetings of the Sanitation Group of the Am. Soc. of Mechanical Engineers. All three of these meaty and up-to-the-minute papers discussing modern grit handling methods and equipment are to be grouped in a single issue.
The authors—

M. B. TARK, Link Belt Co.
R. D. NICHOLS, Jeffrey Mfg. Co.
W. A. KIVELL and N. B. LUND, The Dorr Co.

Temperature Relationship to
Resistance of Coliform Bacteria to Chlorine

Reveals the importance of devaluating the efficacy of nominal residual chlorine values with declining temperatures, and particularly in connection with lime treated waters of high pH values. The author—

GEORGE W. FREIBERG
Anheuser-Busch Inc., St. Louis, Mo.

VOL. 87, No. 1

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This Month's Cover—The striking cover picture on this issue becomes even more so when the fine points of the photography are taken into consideration. The impressive part to us is the fact that it was composed and taken by an amateur—Donald Becker of Durham, N. C.—during the erection of Durham's new elevated tank. Mr. Becker, an up-and-coming young man on the staff of the Durham Morning Herald, contributed the article in last month's issue describing this installation as North Carolina's largest tank.

HALBERT P. GILLETTE, Pres. and Editor-in-Chief; E. S. GILLETTE, Vice Pres. and Publisher; L. H. ENSLOW, Vice Pres. and Editor; JOHN C. BLACK, Managing Editor; J. R. BAYLIS, Associate Editor; A. M. RAWN, Associate Editor; H. A. FABER, Associate Editor; J. M. ANGELL, JR., Eastern Manager; D. G. LEDGERWOOD, Advertising Editor; H. J. CONWAY, Make-Up Editor.

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Instead of running against the disc chamber, the thrust roller runs against this inexpensive, renewable bearing plate, so that the resultant wear will no longer be taken by the chamber itself. This results in more years of satisfactory service and reduces the cost of obtaining better testing meters from the repair shop. New chambers with this feature may be installed in Trident Meters already in service and, if so desired, old chambers may be returned to the factory to be brought up to date.

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WATER WORKS & SEWERAGE

VOL. 87, NO. 1 *A Gillette Publication* JANUARY, 1940

PROGRESS IN WATER SUPPLY AND PURIFICATION DURING 1939

By LEWIS V. CARPENTER
Professor of Sanitary Engineering
NEW YORK UNIVERSITY
NEW YORK CITY

WATER SUPPLY, the depression proof industry, has risen to new heights in an accelerated period of construction during which Federal aid has been given freely to municipal waterworks. A census made by *Engineering News-Record* (Sept. 1939), reveals that now some two-thirds of the population of the United States is served potable water through some 12,750 waterworks. The industry dwarfs such industrial giants as U. S. Steel, Bethlehem Steel, and others. Without fanfare it has slid over into "big business." Impressive, too, are the number and size of manufacturing industries that devote their entire energies to the water supply field. Time was when there was a trend toward private ownership, but that trend has been reversed until now only 27% of America's waterworks are operated by private utility companies.

The Author

The waterworks industry is unique in that the raw product of the 12,750 plants is just enough different that a slightly different form of operation is required in "tailor-made" plants. While, an open hearth steel plant at Pittsburgh can be duplicated at Chicago and give equally good performance, a "universal" water treatment plant would be a failure because of difference of raw products, treatment formula, and required methods of operation.

To pick a single item and say it is the outstanding development during 1939, is impossible. The year 1939 was one of mass integration. Manufacturers have produced better tools with which to work and schools have developed more capable men to operate the additional plants that have been built. This great industry that we have will retain its place among the

Our reviewer needs no introduction to the many readers of this magazine, many of whom have commented so favorably on his reviews of previous years.

It was on this score that Professor Carpenter was chosen as the 1939 reviewer of progress in water supply during the year.

It will be of interest to all, and of concern to his many admirers, that the Professor, having begun the review earlier went through with the assignment while confined to a hospital bed, where at this writing he is slowly recovering from a heart ailment brought on by his characteristically vigorous attack of a heavy work calendar.

If this review fails in any quarter to come up to standards of his earlier contributions, concerning which the Professor expresses some anxiety, we can only say that in his speedy recovery we feel that our readers will be much more interested than in the fact that his handicap may have resulted in the leaving out of one or two developments worthy of note.

If such be the case, and is brought to our attention by interested readers, both ourselves and Professor Carpenter will welcome the courtesy and an opportunity, thereby, to recount such in our next issue.—Editor.

leaders of industry by virtue of an energetic research program which is carried forward regardless of circumstances. We can match programs with any field, because it is hard to find a unit, however small, that is not doing its bit toward solving problems of import to the industry as a whole.

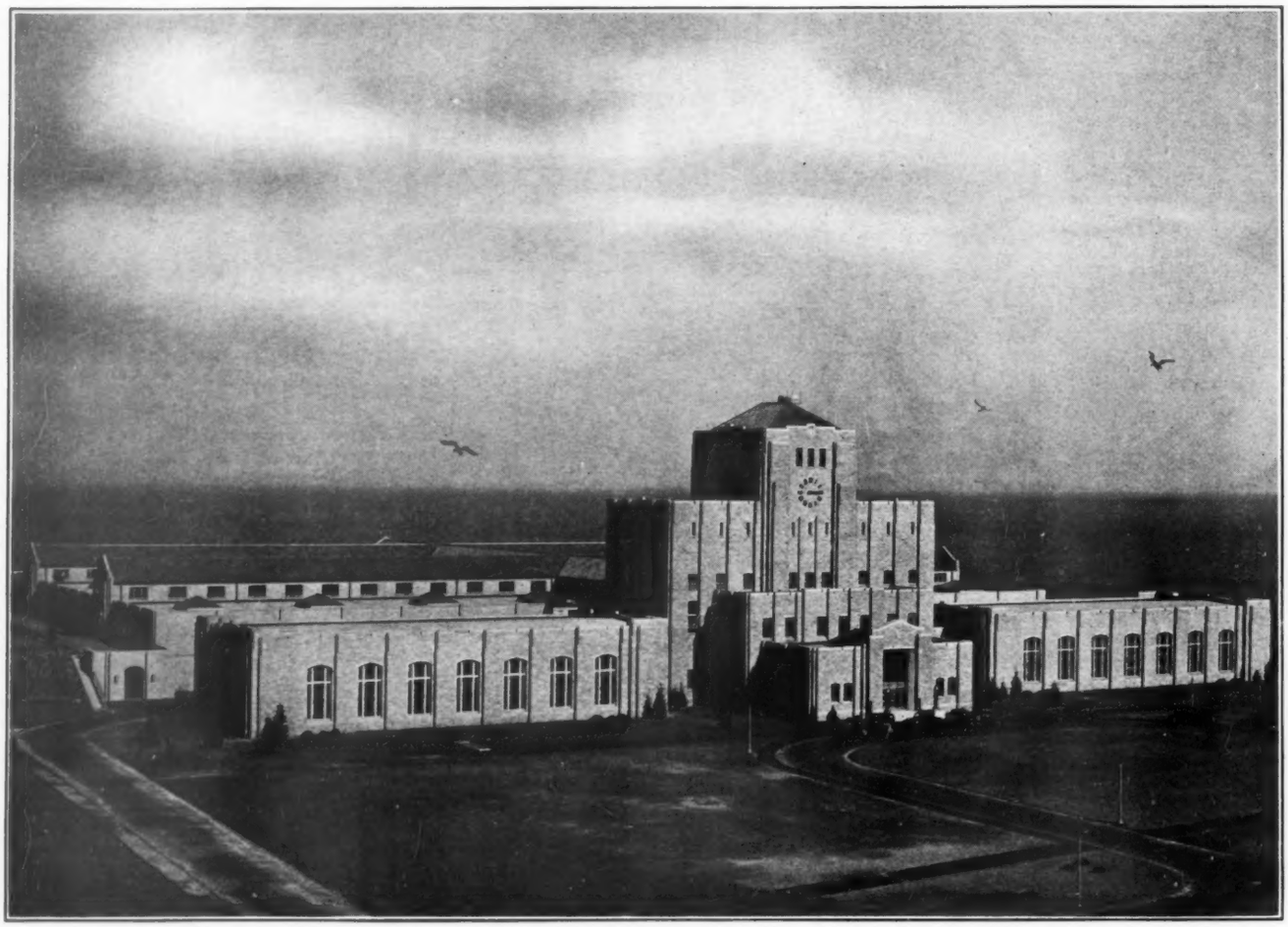
Labor Troubles and Licensing

On December 12, 1938, members of two unions involving engineers and oilers among the plant pumping personnel went on a strike at some of the St. Louis pumping stations. Fortunately, the employees of one of the plants remained loyal and were able to deliver a partial, though inadequate, supply. It was fortunate that no large fires occurred during this period. The strike was settled amicably on December 16, without damage to pumping machinery, etc., but it brought before the waterworks men a very pertinent point, namely, should waterworks men be accorded the privilege of strike? Certainly the privilege of organization should be granted, but some definite form of arbitration should be devised that does not involve endangering the lives and properties of citizens by the stoppage of its water supply. Encouragement of licensing and attendance at short schools should go a long way toward building "esprit de corps" among the personnel that is not engaged in purification. A trend that will include many personnel other than purification men under the licensing regulations would be a distinctly healthful indication.

The American Water Works Association has reaffirmed its action taken on licensing in January 1937, in "realizing the importance of efficient operation of water purification plants as a protection to public health, indorses, licensing, certification, or some form of regulation of water purification operators and supervisors as a means of preventing the employment of incompetent personnel and assuring some continuity of efficient personnel." The Association has made a survey which indicates that, as of November 1, 1939, fourteen states either license or certify and others have certification plans which are now in the making.

The development of short schools has been so rapid that it is difficult to single out those considered outstanding. Most of the schools are now teaching fundamentals, and a new man can go to school with the assurance that the courses will be within his grasp. Some schools have their curricula tied up with their program for licensing or certification. Georgia, South Carolina, California, and New York have had outstanding successes along that line. West Virginia requires licensed operators to answer four questions a month, two of which may be answered if the men have read the more important articles in recently issued national waterworks publications.

Everybody seems to be going to meetings. It is unusual to pick up the report of a meeting and find that a new record has not been broken. The year has been very good for memberships in all societies, with the A. W. W. A. rolls reaching new highs under the able leadership of Secretary Jordan.



America's Plant of the Year
Milwaukee's Five Million Dollar Filter Plant Has a Capacity of 300 M.G.D. and Many Innovations
(The dream of J. P. Schwada, City Engineer, made possible through P.W.A. assistance, and designed by L. R. Howson of Chicago)

Precipitation Deficiencies in the Various States During September, October and November Reveal Drought Conditions Prevailing
(This chart from the "Weather and Crop Bulletin" of the U. S. Dept. of Agriculture, Dec. 12, 1939.)

Climate

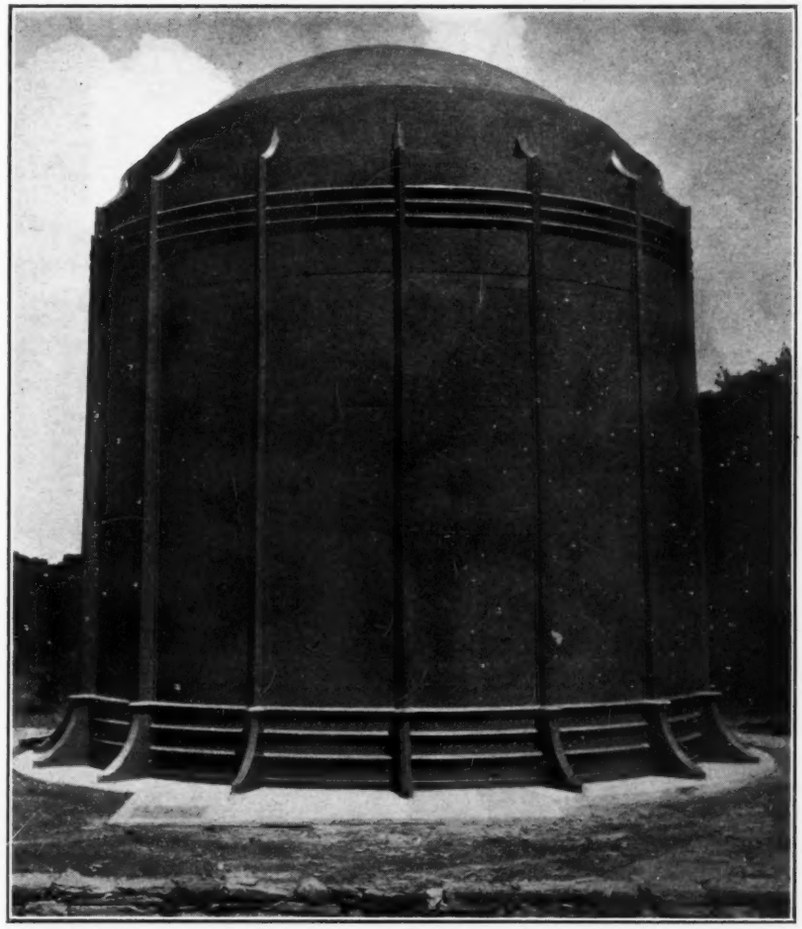
Weather is that thing which everybody talks about, but about which they do nothing. This year has been characterized by a mild winter temperature, practically no floods, and very little precipitation. In fact, this summer and fall produced critical conditions in many parts of the country. Rain is badly needed everywhere. In the month of November, Arizona was the only state with precipitation above the normal. For drought figures, those showing the actual shortage per acre of land are more expressive than mere percentages. For the country as a whole, the shortage of water reported for the three Fall months of 1939 was more than forty billion tons per acre. In the Northeast justified fears exist that a water supply shortage may develop before thawing snow and spring rains replenish the storage basins. New York City has already issued advance warnings to hotels and other large users to curtail waste.

Southern Ontario is experiencing a water shortage which has become serious in some districts. Many wells and cisterns have dried up, and if no rain falls before the winter freeze-up, the water supply situation will become serious.

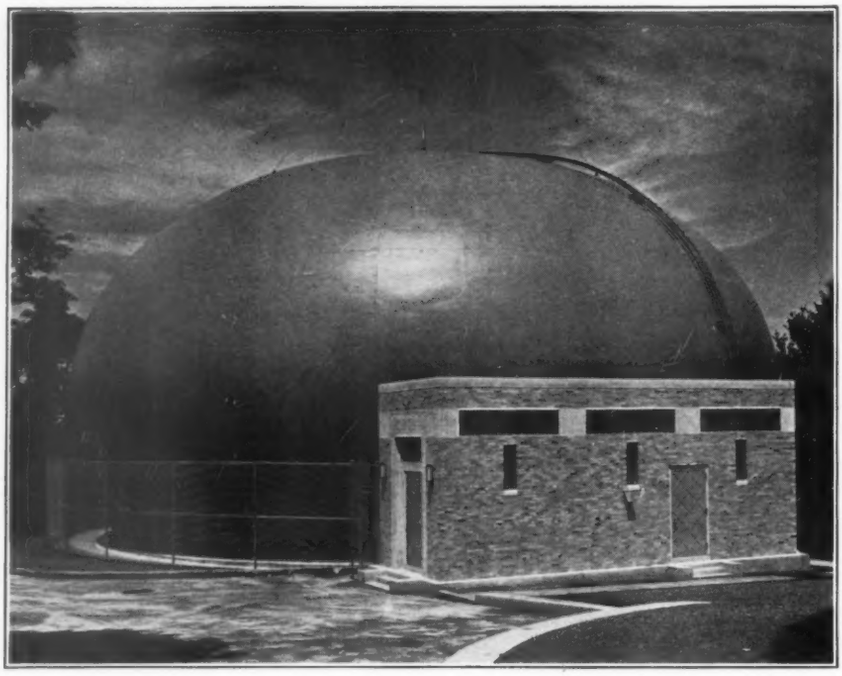
Legislation

With respect to stream pollution legislation during the year, there has been nothing significant other than the two principal bills introduced into the last congress. One was the Barkley bill (Senate-685) and the other was the Mundt bill (H.R.-6723). The Barkley bill in its major provisions follows the recommendations contained in the third report of a special committee of the Water Resources Committee of the National Resources Board which was transmitted to the President in February 1939. This report constitutes a very comprehensive resume of the present status of stream pollution in the United States and includes an appendix setting forth a concise summary of all existing State legislation relating to water pollution. The Barkley bill sets up a national policy for dealing with stream pollution control and creates a special water pollution division in the United States Public Health Service and provides $300,000 per year for its administration. The Barkley bill was first introduced into congress in 1936, has been passed three times by the Senate and twice by the House. The bill was vetoed by the President in 1938 on the basis of certain administrative provisions which were considered undesirable. The revised Barkley bill, now before the Senate, remedies these defects and has been endorsed by practically all of the State Health Departments, Sanitary Water Boards, and sanitary engineers generally.

The Mundt bill places stream pollution control under the United States Army Engineers, and provides $500,000 per year for administration. The Mundt bill is very much more drastic in the regulatory powers conferred than is the Barkley bill and has general provisions which have made it unacceptable to industry and to most of the State Departments of Health.



The Standpipe of Mamaroneck, N. Y.
(Indicative of what a little architectural treatment has done for such structures; and in advancing public relations.)



The Development of 1939 in Water Tanks
(The Hortonspheroid erected at Brookline, Mass.)

The Barkley bill provides for loans and grants to municipalities for carrying on remedial works for the elimination of water pollution. The Mundt bill does not have this provision. Both bills will come up again in Congress in January.

Elevated Tanks

The fabricators of steel tanks come forth year after year with unique and novel designs. This year has been no exception. This summer, a spheroidal tank was completed at Brookline, Mass. It holds 1,666,000 gallons, is only 47 ft. high, and has a diameter of 94 ft. It is said to be architecturally pleasing, but has its limitations as to head.

Lake, Wis., in a unique manner combined the construction of its Town Hall with that of an elevated tank. The town hall on the second floor seats 300 people. Arrangements have been made to add more floors later.

One of the highest and largest capacity water tanks in the country was recently completed at Batavia, N. Y. Indianapolis completed another large elevated tank in their system and Fulton, N. Y., rehabilitated two concrete tanks with very pleasing results.

Public opinion in Denver was opposed to the use of elevated tanks, and the engineers were compelled to install a low level reservoir to meet the peak demand. Taxpayers in Mamaroneck brought suit to prevent the water company from erecting a standpipe, claiming that it would spoil the appearance of the surrounding landscape. With effective architectural treatment the standpipe won in court, and the residents of that ritzy town have been pleasantly surprised with the appearance of the completed unit.

Water Storage and Transportation

Work on many of the combined water supply dams such as Pymatuning in Pennsylvania and the Shasta in California continues to progress. As a rule, our large earth dams are well built because of the proper application of engineering principles, but each year there is usually one or more failures of small water supply dams. A dam at Paris, Ark., was washed out when a record-breaking rainfall of 5.35″ caused the creek to rise 5 ft. in 30 minutes. The municipal pumping plant below the dam was seriously damaged and the town was without water for *three* days.

The Delaware system for New York City water supply continues to be the largest single water supply system under construction. During the year, a sum of $213,617,000 was provided for its construction. Contracts amounting to about $150,000,000 have been let. Toledo is building a new $9,500,000 filter plant. The total number of awards during the first half year exceeded any others in history, but most of the contracts were small in size.

Last April, at the New Orleans convention of A. W. W. A., a paper was given on a proposed method for determining barrel thicknesses of Cast Iron Pipe, which represents results of about 10 years of research and study. A very extensive set of experiments were made at the University of Illinois on the structural strength of pipe, and at the University of Iowa further tests were made based on the position of laying in the trench. While the work may appear to have little significance to the average waterworks man, it will actually enable

And Another Outstanding Example of "Neighborhood Treatment" of Elevated Tanks
(This 1.5 M.G. unit of the Indianapolis Water Co. has surrounding grounds landscaped to add attractiveness to the green and silver structure.)

manufacturers to make pipe with a more rational design and probably at a lower cost. When the work of this committee is completed, it will be another monument to the tireless efforts of Col. Wiggin and his associates. [The report of the Committee on C. I. Pipe Specifications has since the publication of this review appeared in the *A. W. W. A.* Journal for December. It is proposed to stage a discussion of its context at the 1940 Convention of A. W. W. A. in a manner to indicate its usefulness to water works managers and designing engineers.—Ed.]

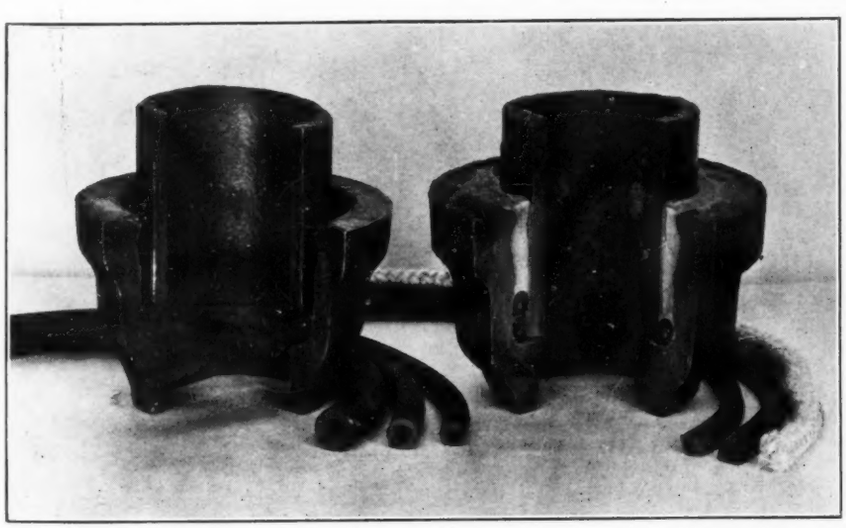
A pipe installation machine that is completely hydraulic in operation is in use at Jasonville, Ind. The machine is designed to push or pull with equal force, is manually operated, and is compact, weighing less than 200 lbs.

Pipe Lining in Place

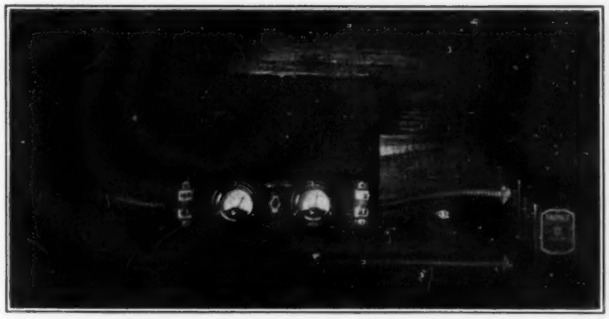
The first job of cleaning and applying a pipe lining of cement mortar to old mains in place in America has just been completed in "the home of cement lined C. I. pipes"—Charleston, S. C. The Tate process, developed in Australia, was employed in the trial project involving 12,000 ft. of small diameter pipes (4, 6 and 8″), some of which was laid in 1880. The "C" values for 6 and 8″ pipes were thus raised to 117 and 128 from an observed C=50 before the rejuvenation.

Tank and Standpipe Protection

Cathodic protection which was presented to the waterworks industry for protection of steel water tanks about a year ago has been going forward with rapidity. Investigations show that if it will work, according to results thus far on water tanks, the small required electrical installation and current requirement is cheaper than painting. Most of the new installations provide an individual electrical converter (A.C. to D.C.) on each tank rather than a single large one covering several. Initial reports are all favorable. The C. & O. Railroad installed cathodic protection on experimental tanks this year and the largest installation is that for the ground storage tank of Milwaukee. The largest for elevated tanks is probably that of the Indianapolis Water Company.



The New "Flex-Sanipac" Joint Developed to Overcome Bacterial Troubles With Jute and Hemp
(An invention of Hayes Kuhns of Ohio.)



Cathodic Protection of Tanks is Provided Through this Little Rectifier of A. C. Current to D. C.
(The Indianapolis tank here pictured is so equipped.)

Main Sterilization

Since the publication of the work of Kingsbury & Adams (Jour. N. E. W. W. A., March 1937), on the bacteria in hemp appeared, the sterilization of new water mains has been a live subject. It is easy to treat a main so that it will deliver good water at once, but Calvert, at Indianapolis, has found it is a hard matter to treat it so that the water will remain good as the days go by, especially in the summer. Experimental work on a line laid with hemp showed 50% of the one ml. portions contained coliform organisms at the end of 56 days. Mains have been laid for at least a century, but apparently the bacteria in hemp do not cause disease, but if bacteria of any kind are present, such reflects on the quality and safety of the supply. For, it must be realized that the presence of the coliform group might indicate a plumbing cross-connection rather than contribution from joint packing.

To combat this difficulty and preclude embarrassment of waterworks managers an all rubber sanitary joint packing has been perfected by Hayes Kuhns of Killbuck, Ohio, which has been used and favorably reported on by the Akron, Ohio authorities and others. (See WATERWORKS & SEWERAGE for May 1939, p. 174.)

Filter Developments

The oldest filter in the State of Pennsylvania (that of New Bethlehem, Pa., built in 1889), was replaced by a slightly modified form of Morse circular all-steel filter plant, believed to be the smallest yet built—720,000 gpd. capacity. The plant consists of a circular sedimentation basin, which occupies the outer ring and provides a four-hour detention period. The outer ring is 49 ft. and the inner 30 ft. Two mixing chambers and two filters are located in the circular section adjacent to the sedimentation basin. A pipe vault occupies the inner tank which is 20 ft. in diameter and formed by the inner walls of the filter and mixing chambers. Eighteen inches of graded gravel rest on a steel plate which is perforated on 6 in. centers with ⅜ in. holes with a deflecting plate above each hole. Modern in another direction the filtering material consists of 24 in. of graded "anthrafilt" placed within 2 ft. of steel wash water troughs. Earlier

designs of this type of filter used metal gratings for filter bottoms but the perforated plate bottom seems to effect a more dependable uniformity of distribution.

At Lorton, Va. the Morse Type Filter Plant during the year became "twins," the original unit having been duplicated with another 1,250,000 gpd. unit alongside.

Porous plate filter bottoms have been installed recently at Larchmont, N. Y., and Flat Rock, Michigan, and at some 30 other places. The latter plant installed the plates to get rid of trouble making gravel and the corroding of the underdrain piping. Grand Rapids, Michigan, reported on experiences resulting from 3 years' operation of two porous bottoms in the Grand Rapids softening plant. Although the filters removed from 10-18 p.p.m. of carbonate hardness, the porous plates had not been clogged with carbonate deposition, largely because of the protective sand bed above.

The Palmer Filter Sweep consists of a two arm revolving agitator similar to a lawn sprinkler. Several units already installed show that it is an extremely simple device to install and maintains the corner of rectangular units in as good condition as the circular area beneath with the revolving arms. It certainly offers another valuable tool for waterworks that are having filtration troubles. Several plants have adopted the Palmer Filter Sweeps and report excellent results.

In some places, it has been found that 15 lbs. of copper sulfate per million gallon of filter area placed in solution, drawn down, allowed to stand overnight, and filtered to waste cleans up the bed when troubles with microorganisms are present.

Goudey has installed an ultra violet ray meter on some of the Los Angeles reservoirs which daily integrates the violet ray units in the daylight at the reservoir site. The maximum algae growths are concurrent with the maximum violet ray presence.

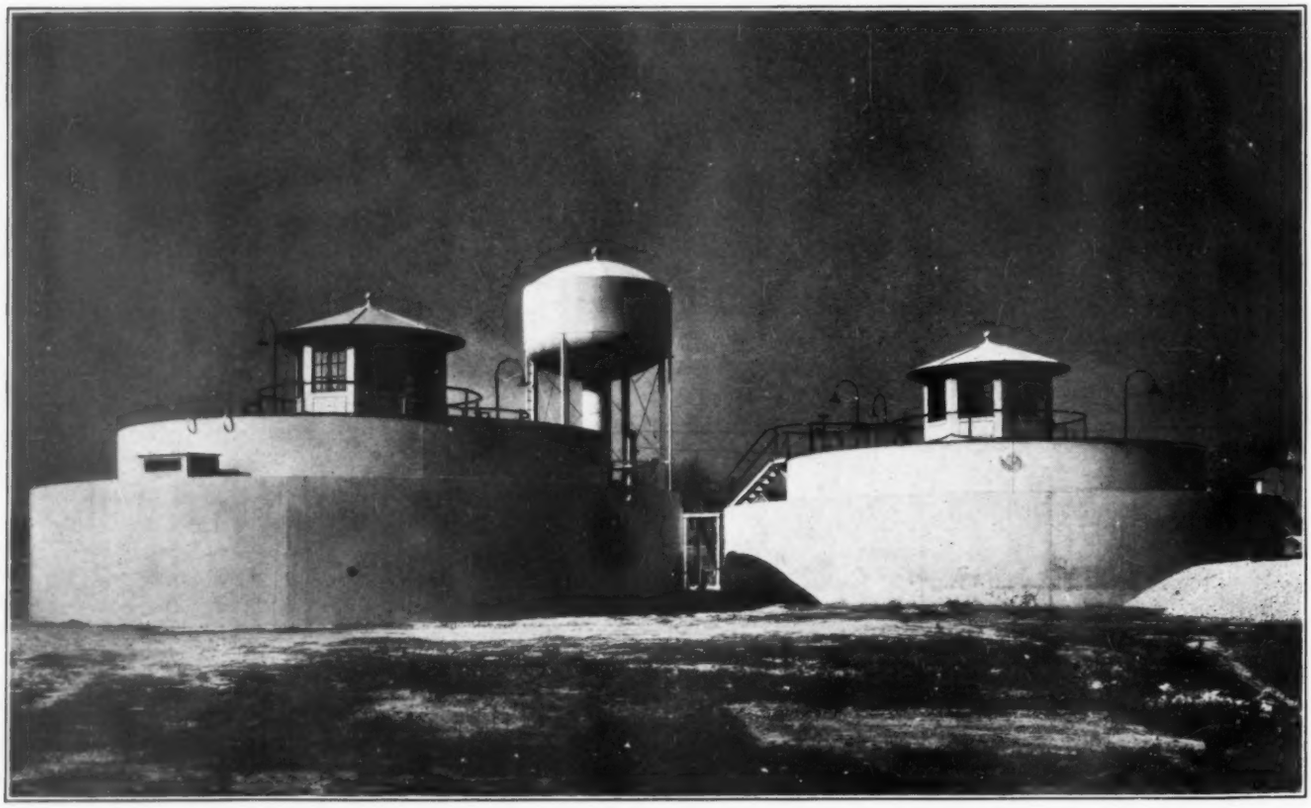
America's No. 1 Plant of the Year

America's No. 1 Filter Plant of the year was without question that of Milwaukee, both as to importance to the community, its size, and the several innovations incorporated in its design. This 300 mgd. plant completed at a cost of $5,000,000 went into full operation during the year. [Milwaukee's plant, the subject of an article by City Engineer Schwada, is, to be featured in a coming issue.—Ed.]

Calgon

In 1939 it was hard to pick up a meeting program without finding two subjects on it, sodium hexametaphosphate and superchlorination. More will be said of the latter later on in this paper. It is indeed unfortunate that use of sodium hexametaphosphate (trade name "Calgon") has been christened by the authors "Threshold Treatment." That phrase was taken several years ago by Spaulding to describe a very useful method of recording tastes and odors and when used otherwise may well prove confusing to waterworks men.

The use of "Calgon" during the past year has been phenomenal and when the effect of this large application has its tendency to reduce prices, the consumption will be still greater. It has been used since 1929 in boiler water treatment. However, it has only been during the past year that its wider application in the waterworks field have become apparent. One of the developments of a few years ago was the "precipitator" and "acceletor" for the recirculation of water softening sludge in an attempt to produce a water in which the water softening



At Lorton, Va. the Single Morse Filter Plant Became "Twins" During the Year
(Each unit has 1,250,000 gpd. capacity.)

reactions have been carried to completion. It has not been possible to accomplish this completely by the addition of these devices to many of the existing plants. The addition of as little as 1-2 p.p.m. of sodium hexametaphosphate will prevent the formation of $CaCO_3$ incrustation in any form. The quantity added is not dependent upon the alkalinity or pH and the quantity necessary is a small part of that required to react quantitatively with calcium in solution. Calgon merely inhibits $CaCO_3$ incrustation and its action is probably due to certain surface-active properties of the molecules of this salt and by the same property appears to protect bare metal surfaces against corrosion. Amongst its advantages is that of eliminating the necessity for recarbonation in water softening practice.

At St. Louis County Water Company, the cost of the two methods were found to be the same at a dose of CO_2 of 75 p.p.m. and at current prices for the hexametaphosphate required to prevent $CaCO_3$ deposition. Extensive physiological research has been made on Calgon at a midwestern university and indicates that quantities far in excess of those used in water plants can be used with safety. "Calgon" seems certainly the No. 1 tool given to the water purification man in the past two years.

The Oklahoma City Water Department has been experimenting with submerged combustion as a practical means of recarbonation. This type of burner requires that both the air and gas be kept at a pressure of 7 to 10 lbs. per sq. in. The burner used does not depend on an incandescent surface for combustion. The inventors claim that it entirely eliminates the many inherent disadvantages in existing recarbonating equipment. Estimated cost at the experimental plant ranged between sixty and ninety cents per million gallons.

Enslow Stability Indicator

Every so often, Linn Enslow comes forth with a clever, practical waterworks idea that makes us all ashamed of ourselves that we didn't think of it sooner. His latest brain child was conceived on the floor of a meeting of the Virginia Section of A. W. W. A. and reported last March. His "Convention-chair invention" has been dubbed the "Enslow Continuous Stability Indicator." It has been said that the continuous indicator is nothing more than a device for making the Marble Test DeLuxe, with an added safety factor over the test as ordinarily performed in bottles or jars and a material saving of time and effort. "Briefly, the indicator consists of two tubes filled with pulverized and granular

The Improved Palmer "Filter Sweep"

(An invention of a Filter Plant Operator at Erie, Pa., this effective device has enjoyed rapid acceptance during the year—and apparently justifiedly so.)

calcium carbonate connected in series. Water, when continuously run through these contact units, will either dissolve calcium carbonate or deposit such if it is not in a stable condition. If the water is aggressive, the degree of corrosivity will be revealed by the titratable alkalinity (calcium carbonate), pick up, and pH value increase, during its passage through. If the water is a lime treated water, it may be an unstable water and deposit calcium carbonate. The latter is revealed by a loss of titratable alkalinity and the pH values decrease," —W. W. & S., July, 1939, p. 283.

This indicator has apparently fulfilled all of the inventor's desires, except his early hopes that he could find a short cut in determining Langelier's pHs. Since the latter is a hyopthetical value, it will still be necessary to calculate it as has been done in the past. The stability indicator has a place in the water field and while it does not yield the Langelier Index the Enslow Stability Index is far more practical and workable. One of the first difficulties experienced with our initial Enslow Indicator was to get the water through the apparatus at a slow enough rate to insure complete stabilization. In our laboratory at New York University we used the initial device for student instruction and were able to solve the minor difficulties encountered. The accompanying picture shows the Enslow Stability Indicator in use now. Well, here's for more and more convention-chair ideas! We in the laboratories have time to work them out, even if we can't get the ideas initially.

Gastro-Enteritis

Engineers like medical words, and when we get hold of a group name like "gastro-enteritis," we make full use of it, because we are able to classify and report on ailments under a scientific name without being checked up on. We now call most everything, from a green apple stomachache to bacillary and amoebic dysentery, some form of "gastro-enteritis." But, admitting our lack of ability as diagnosticians, we must admit that more rigid bacteriological standards of quality of water supply as suggested by Baylis and others are needed. A symposium held at the Annual Convention and at many sectional meetings indicates the tremendous amount of interest and experimental work being done on the subject. Several of the conclusions reached are worth restating:

1) "That more attention should be paid to the type and degree of pollution of raw water . . . . "

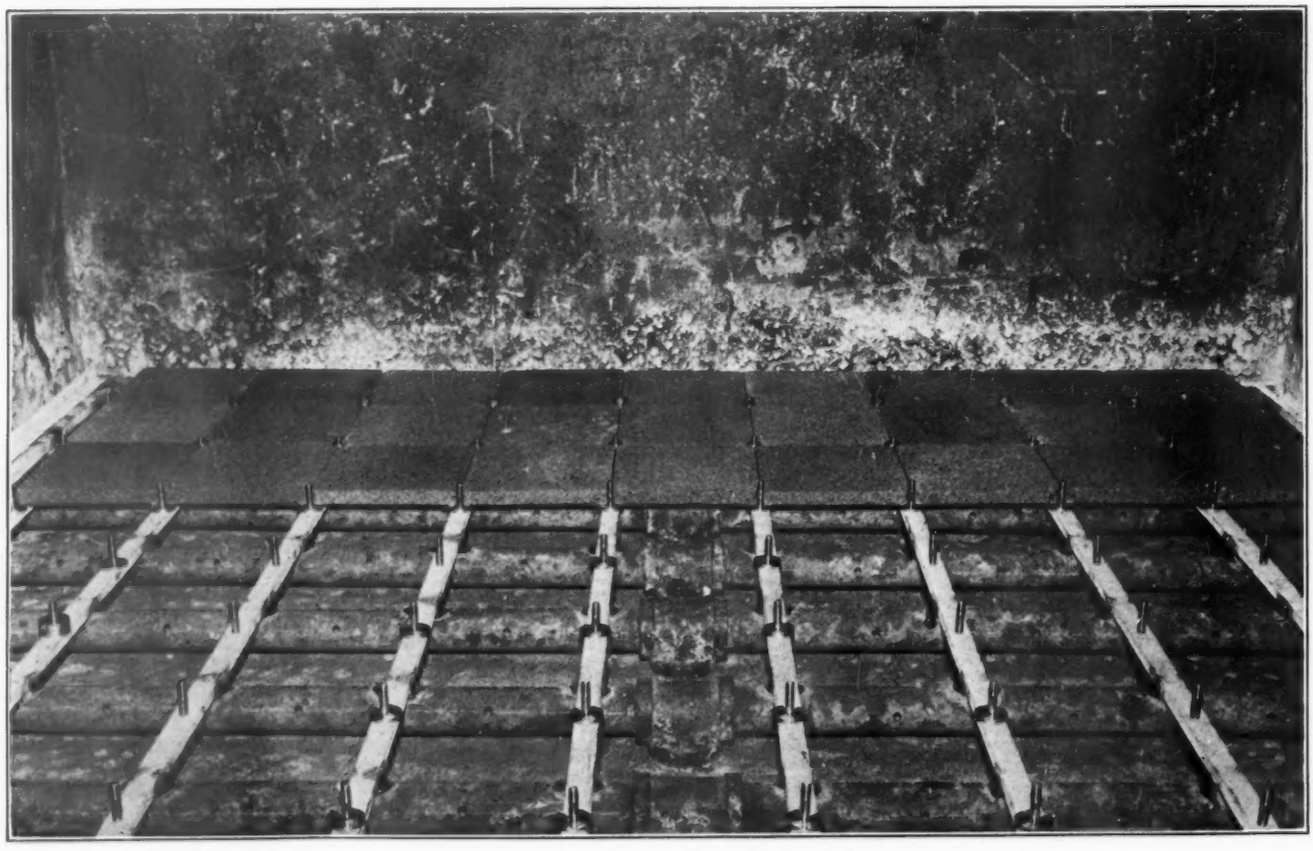
2) "That, based upon available information, the present bacterial standards of water quality are adequate for the control of diarrheal diseases, if they be considered in connection with pertinent physical and chemical data.

3) "That present water treatment processes likewise are adequate, when properly controlled and when they are not overloaded."*

Chlorination is not on trial. Its record stands alone. Except where it is definitely known that an intestinal outbreak was due to toxic poisons, we have no outbreak on our records which has complete enough data to show that true residual chlorine was present in a sufficient quantity at the time of the epidemic. In fact, evidence points to the reverse being so.

Levine, at Iowa State, reports on a study undertaken

* J.A.W.W.A. Vol. 31, P. 1507 (1939).



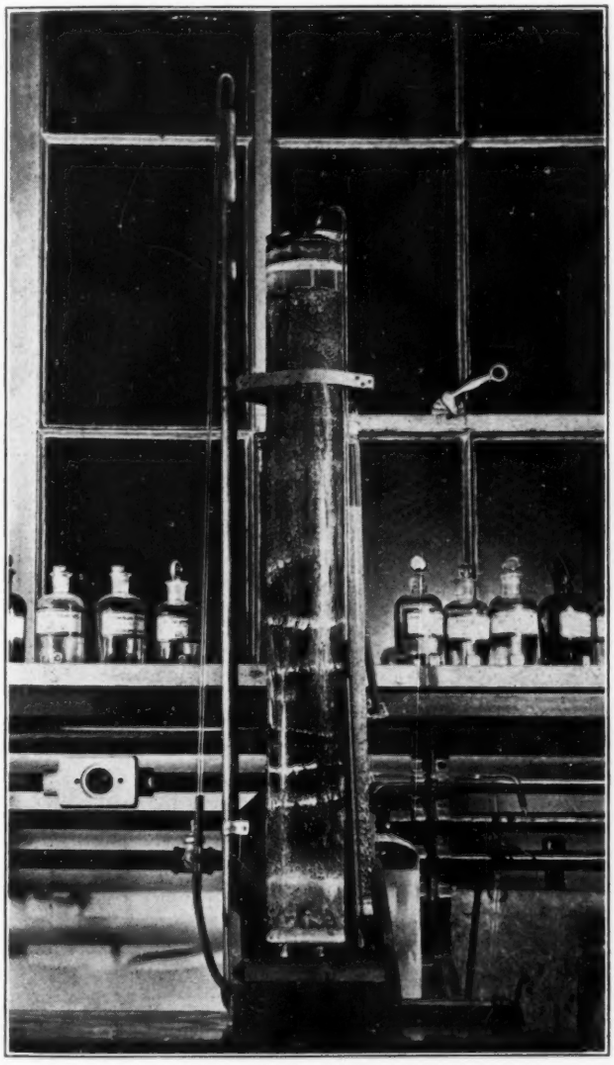
One of the Recent Porous Plate Filter Bottoms

(A unique method of installation was employed to make use of the old pipe-lateral system at minimum expense.)

on the characteristics or organisms, presumably of the coliform group isolated from chlorinated waters. He found that there was some indication that chlorine resistant colon strains were more likely to be encountered in water during summer. There was some evidence that the survival of coli-aerogenes strains in chlorinated water is probably due to the presence of clumps of bacteria or protection of the organisms by some constituent of the water, rather than to resistance of the individual bacteria themselves to the action of chlorine.** Work is being done in many places on chlorine resisting organisms and the results should be available this year.

Bacteriologists continue to present new media designed to speed up the determination of Esch. Coli. The Michigan State College laboratory presents a new media designed to eliminate in a single tube operation gas producing organisms other than true Esch. Coli. Initial results indicate the unproved media very satisfactory in reducing false presumptive tests and it also speeds up slow lactose fermenters.

The latest work being done in the field of bacteriology is that of varying the temperature of incubation.



The Enslow Continuous Stability Indicator
(*Modification effectively used in the laboratories of New York University.*)

Recarbonation by Under Water Gas Burning
(*The diffuser-grid of "Aloxite" tubes has been lifted above water surface at the Oklahoma City plant, where the scheme was developed.*)

Super-Chlorination

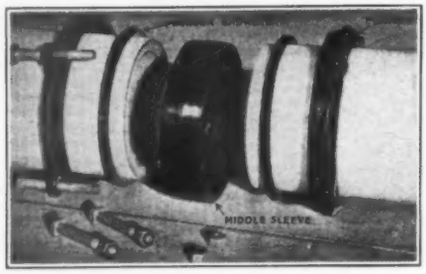
Super-chlorination is definitely not new, but is having a revival this year of the type that usually accompanies the introduction of a new product. The process has been in continuous use at a sufficient number of plants to yield evidence that the control of tastes and odors by this process may be accomplished with efficiency and economy. Failure of many studies using super-chlorination is now attributed to probable lack of sufficient dosage. It is essential that a dosage be used that insures oxidation of tastes and odors. It seem that in the past the term "super-chlorination" was misused, as the dosages applied seem on present evidence to have been less than required to secure oxidation of the taste and odor producing materials. In highly polluted waters, it has been found that the chlorine residual may be materially less than that found to exist with lower doses. Faber* reports that "instances have been found in which the chlorine residual, after adding a high dose will become practically zero or a trace too small to measure. Therefore, it appears that a distinction must be made between the chlorine 'disinfection demand' of water and chlorine 'oxidation demand' of water."

There are several methods of reducing the excess chlorine following super-chlorination. Sulfur-dioxide applied through equipment similar to chlorinators has been the de-chlorinating agent used in the largest number of municipal installations, although activated car-

* J.A.W.W.A. Vol. 31, P. 1553 (1939), W.W.&S. Vol. 86, P. 337 (1939).

** J.A.W.W.A. Vol. 31, P. 1523 (1939).

bon, sodium bisulfite and sodium thiosulfate have been used with more or less success.

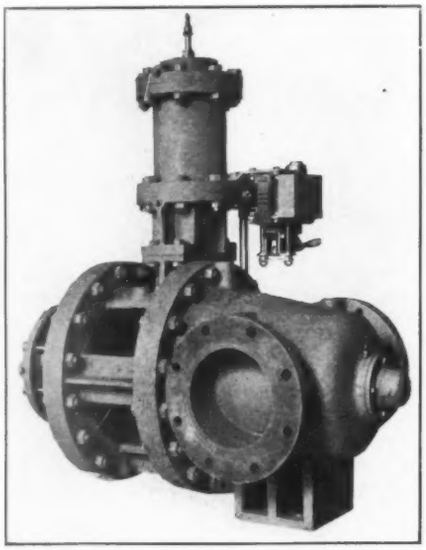


A New Asbestos Cement Pipe Appears on the Market in '39

(Two sections of "Duralite" Pipe and the interesting "Duralite" Coupling.)

It is well known that granular activated carbon has a strong affinity for chlorine and will remove chlorine long after its capacity to effectively remove tastes and odors has been exhausted.

Waterborne typhoid fever continues to appear so that we must use eternal vigilance to prevent its reoccurrence. It has become so rare that many doctors do not

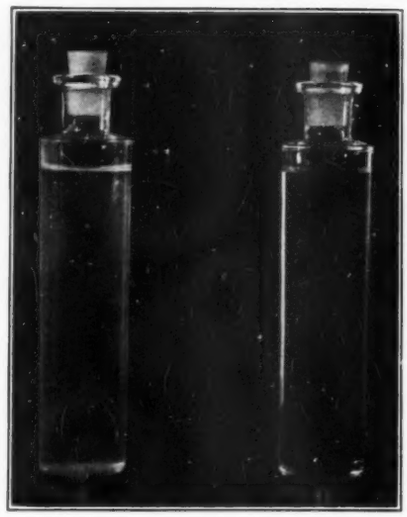


The New Rensselaer Cone-Valve Was Introduced at the 1939 A.W.W.A. Convention.

(It seems to have its points.)

have an opportunity to see a single case of it. The outstanding development from an engineering standpoint was that special court decision in Pennsylvania. In a record setting decision, the Pennsylvania Labor Relations Board awarded $3,000 compensation for typhoid fever allegedly contracted from drinking water on a road construction job. This is the first case where an internal disease has been held compensable.

Griffin, of Wallace and Tiernan Co., has suggested a new test designed to differentiate between the two available forms of chlorine in water, i.e., chlorine or chloramine. It depends upon the ability of chlorine to oxidize nitrites to nitrates and the inability or extreme slowness of the chloramines to bring about a similar change. (W. W. & S., July, 1939, p. 275.)



Hexametaphosphate Treatment Illustrated

(In the bottle on the left, the familiar retarded carbonate precipitation in softened waters; on the right "Calgon" treated water—2 p.p.m. dosage—remains free of precipitate.)

Ozonation

During the year, there has been a revival of the proposed use of ozone. It was used at the Aquacade pool at the World's Fair with ordinary results, used in conjunction with hypochlorite fed from a pressure pot. An experimental plant for the study of ozonation was operated at Moorestown, N. J., and a large scale installation is under way at Whiting, Indiana. Results and cost data will be awaited with interest.

In view of the renewal of interest in the process, the experiences of Delhi, N. Y., as reported by C. R. Cox of the N. Y. State Dept. of Health are pertinent. Cox concluded from experiences with ozonation at Delhi, that "the disadvantages of the ozonation process for the smaller community without expert supervision far outweighed the admitted advantages such as organic matter destruction and freedom from taste and odor troubles."

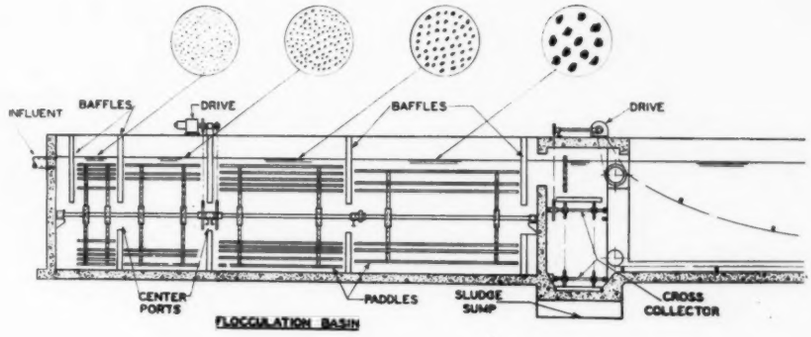
There have been no new developments reported on the catadyn process.

Miscellany

In summarizing developments for any year, there are a number of things which are not new, but are worthy of recording. Clarksburg, W. Va., installed a 4,000,000 gallon zeolite softening plant; the use of a fine mesh rotary screen for algae straining at Menasha, Wis.; repair of an underwater pipe line across the Kennekee River at Bath, Me.; the $1,365,000 improvement to the Charlotte, N. C. water plant with 3-stage mixing and coagulation; and the reduction in pumping costs due to replacement of obsolete pumping units; and the organization and placing in operation of the National Plumbing Laboratory at the University of Iowa. This laboratory tests various types of plumbing fixtures for safety against back-siphonage. Some engineers feel that the waterworks responsibilty should stop at the curb, but we find that court decisions in Massachusetts during the year have upset this idea, as is recounted on page 154 of the April 1939 issue of this magazine and editorially treated in the same issue. The National Plumb-

ing Laboratory at the University of Iowa is doing a service to those of us who think that water quality should not be allowed to suffer degradation at any point in the system—including the consumer's piping.

Bids for a new water filtration and softening plant to be built by the Metropolitan Water District of Southern California for handling Colorado River water intended for domestic and industrial uses were opened October 27. The plant will be of the lime-zeolite process and will provide filtered and softened water for everything except irrigation. The lowest bid was $1,632,992.20.



One of the Rapid-Mix: Slow-Mix Flocculating Devices
(This one, known as the Jeffry "Floc-trol" was introduced in 1939.—Largest installation is at Indianapolis.)

The report of waterworks lettings shows that for the first eleven months of 1939, 50 percent more contracts were let than for 1938. And remember 1938 was a banner year. Our industry is powerful.

A review of this type should not close with apologies, because a reader is lead to expect not apologies but statements of fact. This review, started earlier, had to be completed from a bed in a hospital at a time when most of us were glued to the radio to see if the Admiral Graf Spee got out of the harbor at Montevideo. At such times as this, one is likely to be disorganized in the presentation of logic. But how pleasant it is to be out of war. I picked up a copy of *Water & Water Engineering* for November 1939 and was looking at advertisements. In an ad on page 35, Wailes, Dove, Bitumastic, Ltd., in a war time message to all water engineers, offers "blackout" and "camouflage" paints. Another company offers "War Time Meters." All of our advertisements are relieved from the exigencies of war and we feel sure that the prosperity that our industrial giant enjoyed during the past year has not been dependent on war and that the giant will continue to grow, not only in size, but in affluence in local and national affairs.

With Inexpensive Architectural Concrete Attractive Plants Have Resulted With But Little Additional Cost
(This one at Denver, Pa.)

DOES MAIN CLEANING PAY?

Some Recent Experiences of the West Virginia Water Company and Results Therefrom*

By WM. S. STAUB
Engineer
WEST VIRGINIA WATER SERVICE CO.
CHARLESTON, WEST VIRGINIA

WE HAVE just completed main cleaning projects at three of our properties in this state. This, our first adventure in this kind of main restoration, will serve as index of merit of the process. We have definitely raised the flows and pressures in those mains that have been cleaned and, in cases of the transmission mains, the pumping cost per million gallons has been reduced.

The purpose of this paper is to present our ideas of main cleaning, why we clean mains, what results we have had, the cost per foot to clean; to give a general description of the procedure and to observe what happens in a cleaned main.

In years gone by, when there was no water treatment or when the practice was in its infancy, beyond taste and appearance other characteristics of the water were given little thought. Therefore, the distribution system suffered, due to lack of knowledge of corrective treatments. The deposition of the solids and the tuberculation reduced the area of the pipe and, therewith, the amount of water that would flow through the pipe under pressure available. Consequently, today, when there are complaints of poor pressure, or when increased fire flow is in demand, we are faced with the problem of main replacements or improvement of existing mains. Although the exterior of the pipe is usually as good, practically, as the day it was installed, the interior may present a scene comparable to the stalagmites and stalactites of the eastern caverns. If such choking deposits can effectively be removed from the pipe and the carrying capacity appreciably restored there will be a great savings over replacements, even though the latter be necessary eventually.

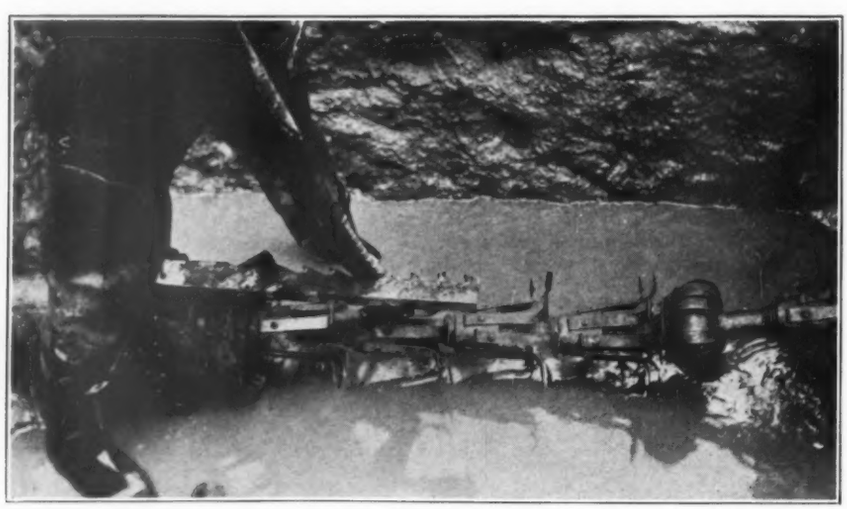
The Author

A dirty main is definitely a liability. From the operating standpoint a dirty transmission main consumes many kilowatt hours of power due to the added friction. Kilowatt hours in turn cost money, which in turn increases operating expenses. A dirty main is a great handicap to the fire departments, due to insufficient quantities of water. Poor pressure complaints from consumers are not soothing melodies to a superintendent's ears. Consequently, evereyone suffers from the effects of tuberculated pipes.

Locating the Trouble

When a main is suspected of being tuberculated, or when we find that the operating head on a pump is much greater than the static head plus the calculated friction head for new pipe, it is time to find the trouble. The distribution main is isolated in such a manner that all water going to a certain area must pass through the section of pipe to be tested. Then, in the early morning hours, the calibrated pressure gauges are placed along the line and a hydrant is opened at the end of the line. The amount of water is measured with a pitot-tube, the pressure drop is recorded and the loss per 1000′ or the value of "C" is determined. (For details of the method see "Hydrant Discharge Measurements," page 183. Reference and Data Number of Water Works and Sewerage, May, 1939.)

We admit this method of determining "C" is not as accurate as secured by Pitometer tests, but we feel that a reasonable accurate value is obtained if precautions are used.



"Jacking-In" Operation

About half of a cleaning tool jacked into an 8 in. main. It will travel under its own "steam" by main pressure turned in behind it.

* This paper presented before the West Virginia Section of A.W.W.A. is here reproduced by permission of the Association.—Editor.

A Small Line "Make-Up"

In which the "carrier" with threading cable attached (see next cut) has been inserted in 4 in. main and ready to travel.

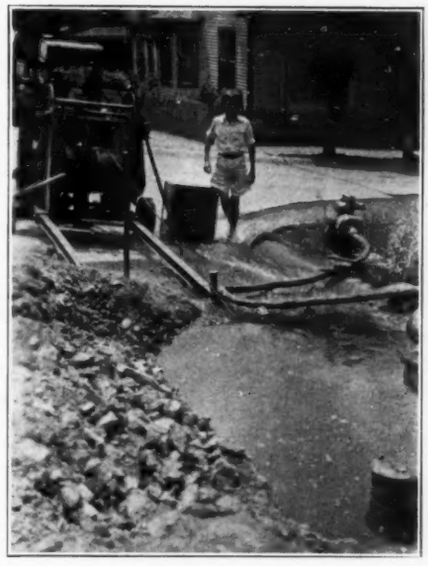
In the case of transmission mains, by determining the efficiency of the pumping equipment, static head, operating head, power consumed, water pumped, it is possible to get a very good check over any period. (For "A Simple Method for Checking Pump Efficiencies" see page 445, November, 1939, Water Works and Sewerage.)

Cleaning Procedure

The largest pipe which we cleaned was 10" cast iron. The 10" and 8" pipe was cleaned with the pressure cleaning machine, which uses the water pressure to push the device through the pipe. This machine (see pictures) is about 6' long, composed of five cutting heads and two pistons. The heads are "vertebrae" upon which are attached, around the circumference, the cutting blades. The blades are of spring steel. There are two flexible "pistons" from which the machine gets its drive. There are adjustable ports through the pistons, which we can set to control the volume of water passing the machine for sweeping the debris ahead and, at the same time, to prevent the machine from moving too rapidly. Closing the ports naturally gives added driving power for the tougher jobs. The pistons and cutting heads are on a flexible spring and cable type of shaft. Its flexibility will allow the machine to pass a standard 90° bend. Contrary to the belief of many, the machine does not take on any spiral or whirling motion in its travel.

Cleaning 8 and 10 Inch Mains

The main is isolated and a section of pipe is removed at the point of beginning. This section should be long enough to give ample working room for inserting the machine. The machine is then jacked into the pipe (see cut) and the pipe permanently jointed either by solid or Dresser sleeves. At that point at which we wish the machine to emerge the pipe is again cut. A short section is removed and bell and spigot fittings are used to rig a riser. Usually this is done with a 45° bend and a short piece of pipe. The joint need only be juted and chained. The purpose of the riser is to discharge the debris on top of the ground, rather than in the trench. When the riser is rigged the pipe is all ready. The valve on the main is opened slowly to secure the proper amount of water and the machine begins to move. The machine generally moves about 100 feet per minute and it is possible to follow its travel through the line, as the water passing the pistons and the scraping blades is audible at the surface. Generally the water emerging from the riser will only be colored until the machine gets within about 300 feet, then the water is thick and black .(See cut.) The solid material may issue from the pipe like sausage, if the encrustation is marked. In the case of the 3900' of 10" line in South Charleston (W. Va.) there was an estimated one and one-half tons of solid material which came from the pipe. The machine will generally lodge in the riser pipe due to so much debris, and has to be helped out. When the machine has reached its destination (after only one trip through in most cases) the riser is dismantled, the main flushed, jointed, and placed in service.



The Safety Winch

Pulling cleaning tool through a 4 inch line. In such operations the debris collects in the ditch which is dewatered with the small portable pump alongside.

The "Carrier"

A rod with leather piston cups is used to thread cable through 4 and 6 inch mains.

Cleaning 4 and 6 Inch Mains

In the case of 6" mains, where they are not so dirty, these may be cleaned by "pressure shots" as described for larger sizes of pipe. In one case where the pressure was low a booster pump was used to supply increased pressure for a 6" "pressure shot." However, generally 6" mains must be cleaned the same way as 4" pipe, which I will now describe.

In cleaning 4" mains the section to be cleaned is isolated and the main opened at both ends. At the beginning point a small cable is attached to a "carrier" and inserted into the

"Black Soup"

From the 45 degree riser the cleaning tool on the ground has just been spit out of this 8 inch line.

line. The "carrier" is a short rod with leather pistons. (See cut.) The main is then jointed at this point with a portable coupling known as a "makeup." This "makeup" has a gland in the top through which the small cable may be fed. The water is then turned on behind and the water velocity takes the "carrier" and the small cable to the other end of the pipe. This small cable is then used to pull the big cable back to the point of machine insertion. The makeup is removed, the cleaning tool clamped to the large cable (see cut), the main permanently jointed, the water pressure turned on, and the cleaning tool is pulled through the pipe by a gasoline driven winch. This process is much slower than the pressure method and great care must be exercised to prevent breaking the cable and loosing the machine. In this case a very slow speed is used. The winch automatically releases the clutch when the tension or pull becomes too great. This generally happens when the cleaning tool caught some joint lead or a bad obstruction. When the cleaning tool emerged the main was flushed and permanently jointed.

Obstacles Encountered

In pressure cleaning the drive of the machine is dependent upon the velocity of the water acting on the pistons, and in the event the machine encounters a cross increasing on the branches it will generally stop. In other words, in cleaning an 8" pipe, if at an intersection an 8 x 10 inch cross is present the machine will hang. This is due to the pistons expanding and allowing the water to pass it instead of driving the machine.

If the wash water passing the machine is not sufficient to carry the debris ahead the machine will be fouled. We encountered one 8" main in which the machine would move a short distance, then stop. After the wash water had moved the material ahead the machine would move again. This happened on a long line where wash water was insufficient and blowoffs were too far apart. The machine had to re-run through this section and I am of the opinion that part of the debris was deposited behind the machine during the first cleaning.

An Ounce of Obstruction; A Pound of Cure

This section of 8 in. pipe didn't look "too bad," but results after cleaning showed that it was. Proof found in the accompanying tables of data, revealing the "before and after" story, is more convincing than many words about it.

Short radius bends with valves on one side caused several cuts to be made.

Insufficient pressure was a jinx on one job. We were cleaning a 10" main from the reservoir down the hill. The pressure at the point of beginning was only 17 pounds. Thus it was necessary to fill the line with water and bleed it rapidly at the bottom of the hill, thus creating a vacuum. When this was done it was then impossible to keep up with the machine.

Dollar Loosing Debris

Some of the one and one-half tons of solid material swept out of 3.976 ft. of 10 in. transmission main, to reduce pumping costs $2.37 per million. (See accompanying tables of data and costs.)

TABLE 1—Charleston Main Cleaning

Item	Pipe 6" Kanawha St.	Pipe 8" Va. St.	Pipe 10"* So. Chas.	Pipe 10"-8"** Nitro Line
Contract of Cleaning	$134.80	$271.70	$397.60	$1,488.95
Material Cost	6.19	48.86	138.29	250.40
Labor Cost	65.86	186.80	188.14	888.09
Total Cost	206.85	507.36	724.03	2,627.44
Number of Feet Cleaned	1348	2717	3976	29779
Cost per Foot	$ 0.1535	$ 0.187	$ 0.1823	$ 0.0834

* This cost does not include 8" temporary steel line which was laid. The rental of pipe, placing and removing cost $1,757.75 for 4200'. If this were added to the above the cost per foot for cleaning the 10" main would be $0.625.

** The 10" and 8" main is a transmission main and was cleaned as one unit. Therefore there was no breakdown in cost.

TABLE 2—Charleston Main Cleaning (Transmission Main)

Location	Size	Feet of Pipe Cleaned	"C" Before Cleaning	"C" After Cleaning
South Charleston	10"	3,976	66	130*
Nitro-Dunbar	10"	10,679	49	130
Nitro-Dunbar	8"	19,100	49	126
Charleston-Virginia St.	8"	2,717	—	138
Charleston-Kanawha St.	6"	1,348	—	115

* Yielding an estimated savings in pumping cost (power) of $2.37 per M.G. for the South Charleston main.

Poor joints were responsible for a number of worries—poorly juted joints where the lead had run into the pipe. There were chunks of lead removed weighing 50-75 pounds, old pump gaskets, coil springs, timbers, rocks and, in one case a piece of 1½" pipe about 6 feet long. These had probably entered the system years ago when reservoirs were uncovered or when the pipe was laid.

Discoveries and By-Product Values

At Hinton practically the entire system was cleaned. As a result, the method in which tie-ins are made, the fittings, and location of mains were definitely established. I know that our superintendent there can now point out on the ground just what is at every intersection, because he made intersection cards accurately during the cleaning.

There were cases when a pipe which was supposed to be was not and vice versa. Old valves were found, some with box and all gone, some with stem broken and some found partly closed.

If anyone operating a water system, which has been in service for a number of years, attempts a job of main cleaning, he will probably be surprised at a great many things found. And, from the operating standpoint, the knowledge gained during cleaning of mains may well save a few nights sleep to the superintendent.

Conclusions

We feel that our main cleaning jobs have done a lot of good. Those who have seen the mains before and after know that flows have definitely been improved. Just how long this pipe will remain clean is another question, but we expect to keep a close check on the cleaned mains. In fact, we are taking daily samples at all points where we cleaned and are recording the pH, alkalinity and CO_2. Periodic flow tests will also be made to ascertain to what degree the main is tuberculating. We are trying to control our corrective-water treatments accordingly.

We do know that fire flows have been greatly increased and that once weak hydrants are again gushing briskly. On transmission mains there have been definite and pleasing reductions in power consumed.

Costs and Cleaning Data

In the accompanying tables something of the data pertaining to cleaning operations and costs are presented for the benefit of those interested.

TABLE 3—Hinton Main Cleaning (Total Cleaning Costs)

Item	10" C.I.	8" C.I.	6" C.I.	4" C.I.
Contract of Cleaning	$177.40	$ 546.90	$255.60	$ 675.80
Labor Costs	42.92	238.33	185.60	376.86
Material Costs	44.25	245.54	189.30	301.96
Total Cleaning Cost	264.57	1,030.77	630.50	1,354.62
Cost per Foot	0.15	0.189	0.246	0.20

TABLE 4—Hinton Main Cleaning

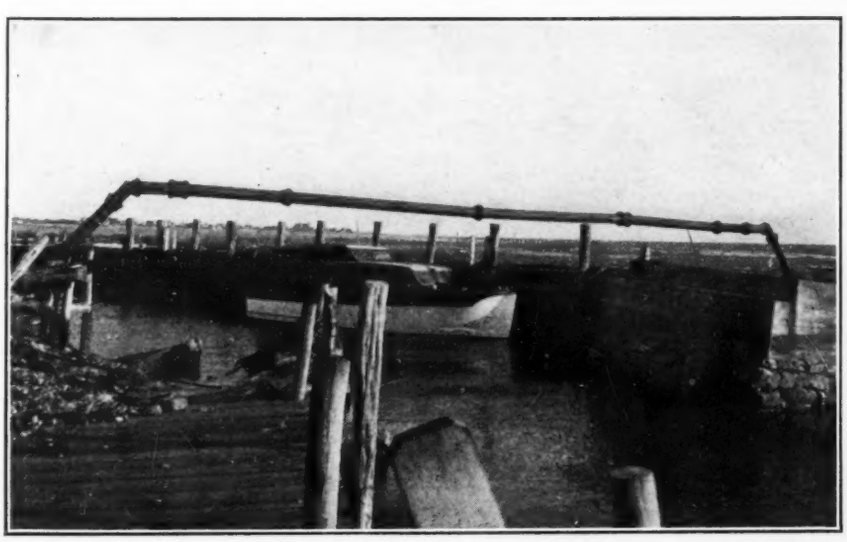
Size Pipe	Ft. of Pipe Cleaned	No. of "Shots"	Max. Length "Shot"	Min. Length "Shot"	Ave. Length "Shot"	"C" Before Cleaning	"C" After Cleaning
10"	1,774	1	1,774'	1,774'	1,774'	—	128
8"	5,468	9	1,072'	215'	608'	48	126
6"	2,556	7	675'	189'	365'	80	117
4"	6,758	14	965'	36'	482'	44	122

TABLE 5—Sutton Main Cleaning

Item	Pipe 6" Main St.	Pipe 4" Town Hill	Pipe 4" South Side
Contract of Cleaning	$177.00	$325.40	$487.50
Material Cost	18.55	72.60	105.60
Labor Cost	90.50	166.40	249.20
Total Cost	285.85	564.40	842.30
Number of Feet Cleaned	1770	3254	4875
Cost per Foot	$ 0.161	$ 0.173	$ 0.172

TABLE 6—Sutton Main Cleaning

Location	Size	Ft. Pipe Cleaned	"C" Before Cleaning	"C" After Cleaning
Main Street	6"	1,770	42	136
Town Hill	4"	3,254	68	118
South Side	4"	4,875	71	117



Sixty Feet of Dependability

This 6-in. C. I. main of The Guilford-Chester Water Company at Old Saybrook, Conn. (60 ft. of it) proved that it "could take it" during the New England hurricane. Fortunately for many, it was not fastened to the missing bridge and withstood the wind and waves on its own. It continued to give service under 60 lbs. pressure (without a leak) during the catastrophe, and for 6 months thereafter. The value of joint strength is apparent. Involved are 14 joints of "Hydrotite" compound poured eleven years ago.

N. C. SECTION STAGES REAL COMEBACK

Charlotte Meeting Reminiscent of Hey-day Conventions

The Charlotte Filter Plant
(Note "Mare and Colt" tanks.)

WHEN the North Carolina Section of A. W. W. A. drafted "Bill" Piatt of Durham, as its president in 1938, it knew what it was doing. And, when the energizing Chairman named as his "top-sergeant," R. S. Phillips, Chief Chemist of Durham's Water and Sewage Department, to serve as Secretary-Treasurer, he knew what he was doing. And, when A. W. W. A.'s Board authorized North Carolina's Director, Paul Frisk, to report back that the Section could spend up to $100 for meeting publicity and a membership drive, it knew what it was doing.

Evidence of the net result of spirit, leadership, go-gettiveness and a little money to spend on publicity, was found in the Annual Joint Convention of the N. C. Section and the N. C. Sewage Works Association, held in Charlotte on November 6th, 7th and 8th. This Convention had all of the ear-marks of those staged by the N. C. Section in its hey-day period of strong leadership and attainments, when year on year it captured A. W. W. A.'s Hill Cup for record membership gains and became recognized as one of A. W. W. A.'s outstanding Sections.

The registration at the Charlotte Convention of 250 and the 43% member gain during the year denotes a real come-back. Yes—the old spirit was there, too.

No little credit must go to the local committee on arrangements, headed by W. M. Franklin, Sup't. of Water and Sewage Treatment Plants at Charlotte, for the smooth running of the convention; and, to Professor W. H. Hall of Duke University and his committee for the well arranged technical program, also notable for the fact that it was not overcrowded.

Awards and Honors

The George W. Fuller Memorial Award (to a member in recognition of outstanding or meritorious service) was most appropriately and effectively made to Dr. H. G. Baity, Professor of Sanitary Engineering, University of North Carolina, who for many years served as Secretary-Treasurer of the Section during which time it grew and prospered. Dr. Baity was cited for his long and effective service to the Section; his noteworthy services to the State and its municipalities, as a sanitarian, a teacher, and leader of men.

Retiring Chairman
Wm. M. Piatt
Consulting Eng'r.
Durham, N. C.

Incoming Chairman
George S. Moore,
Sup't., Water, Light and Sewage
Albemarle, N. C.

The M'Kean Maffitt Cup, awarded annually to that member responsible for securing the greatest number of new members during the year, was won by Charlotte's W. M. Franklin, who seemed to have found time to gather in new members in addition to handling local arrangements productive of a top-notch Convention.

Entertainment

Following an inspection trip to the recently revamped and enlarged Vest Filter Plant and Pumping Station and the Catawba River Pumping Station, a dinner in the South's best barbecue style was served at the Filter Plant, with compliments of the manufacturers' representatives of Charlotte.

An Honorary Luncheon was given National Officers of A.W.W.A. in attendance, at which President J. Arthur Jensen appeared as the No. 1 Guest of Honor, flanked by five past-presidents of A.W.W.A. and Secretary Jordan, Treasurer Brush and Chairman Enslow of the Publication Committee.

On the last evening the Annual Dinner and Dance drew a record attendance. Professor T. S. Johnson, N. C. State College, did a splendid job as toastmaster, as he had also done in presiding at the luncheon. Between the dinner and dance a sound-movie, picturing the production and fabrication of aluminum products, and the part played by aluminum in water and sewage treatment equipment, was shown by H. A. Lilly, of the Aluminum Company of America, a former member of the Section.

The following were unanimously elected to office for the ensuing year:

Chairman — George S. Moore, Sup't. Water, Light and Sewerage, Albemarle, N. C.

Vice-Ch'mn.—Robert W. Luther, Plant Superintendent, Elizabeth City, N. C.

Secy.-Treas. — R. S. Phillips, Sup't. Filtr. & Sewage Treatment, Durham, N. C.

National Director—J. W. Kellogg,* Ass't. Director, State Laboratories, Raleigh, N. C.

(*Takes office at the close of the 1940 A.W.W.A. Convention.)

Members of Sewage Works Federation, Board of Control:

W. M. Piatt, Consulting Engr., Durham, N. C.

Prof. H. G. Baity, Chapel Hill, N. C.

(1) H. S. Sumter, Sup't. Sewage Treatment, and Glen Sigmon, Foreman, Water Dep't.—both from Hickory, N. C.—(the home of the famed mustaches); (2) A couple of "Supers"—T. R. Sherrill (Mooresville), and W. A. Donaldson (Davidson); (3) And, two more of the same, L. A. Poteat, Sup't. at Bessemer City, N. C. and R. T. Mills, Sup't. at Southern Pines, N. C.

Operator Certification Proposed

As Chairman of a committee of the recently formed North Carolina Water Works Operators' Association, Director P. W. Frisk presented a report advocating a plan of voluntary certification for water works operators, in preference to further attempts to secure legislative action in the direction of an Operators' Licensing Act—or, at least, until such time as the effectiveness of the voluntary plan might be thoroughly tested.

Dr. H. G. Baity
University of N. C.
Chapel Hill, N. C.
(To him the Fuller Award.)

R. S. Phillips,
Ch. Chemist
Water & Sewerage Dep't.
Durham, N. C.
(New Secy.-Treas. of Section.)

The report, read in full by Mr. Frisk, embraces a recommended plan based on desirable features found in similar plans now in effect in other states, and in such licensing acts as are now in existence. The plan calls for the election of an Examining Board, consisting of 2 filter plant operators; 1 plant superintendent; 1 consulting engineer; 1 professor from an engineering school.

Three classes of certificates are to be issued to "A," "B" and "C" grade operators, found worthy of the grade by board examinations. The Sanitary Engineering Division of the State Department of Health, is designated as the issuing agency. All operators desiring certificates will be required to pass examination for the Grade "C" Certificate before applying for higher grades. Between each step-up in grade a minimum period of one year must be served in the grade next lower. Thus every operator will enter the plan on a common base of standing, and work his way up as may be. The report outlines minimum requirements in the way of experience, training and education for the several grades.

No action was taken by the N. C. Section in respect to the report which is being circulated among members for subsequent action. In the interim,

W. M. Franklin
Sup't. Water and Sewage Plants
Charlotte, N. C.
(Chairman of Local Arrangements, and Maffitt Cup winner..)

D. S. Abell, Engr.,
State Dep't. of Health
Raleigh, N. C.
(As Vice President had to do the honors for his incapacitated President.)

final action will be taken on it by the Operator's Association—an offspring of the Annual Short School for Water and Sewage Works Operators which is doing such effective work in operator training.

Technical Sessions

The first paper of the technical sessions was that on the **"Effect of Air Conditioning on Water and Sewerage Facilities"** by W. M. WALLACE, Consulting Engineer, Durham, N. C.

The various systems of cooling in producing the refrigeration were described briefly by Mr. Wallace. Concerning water demands, he pointed out that household and office units of less than 1 ton per day of refrigeration were practically all air-cooled types, therefore added no load on water systems. Coming to the favored evaporative condenser, (because of its sparing use of cooling water) Mr. Wallace explained that it was a combination of a cooling tower and condenser. He then described a recent installation in Durham, N. C., which involved a concealed forced-draft tower with water recirculation at the rate of 2.5 gal./min. per ton of refrigeration. Its operation involved make-up water to replace evaporation losses of but 0.0275 gallons per ton of refrigeration and 0.03 gallons/ton as the loss due to other causes—a total of 0.0575 gallons per ton. During the past season in this, Durham's most important installation of 137 tons/day capacity, only 312,000 gallons had been consumed.

Concerning adequate cooling water, Mr. Wallace said that in the case of units of 5 tons or less it had proved more economical to buy water and waste it. Otherwise, the installation costs would be about 50% greater.

"The Vest Pumping Station and Filter Plant"—by GEORGE S. RAWLINS, Consulting Engineer, Charlotte, N. C.

Mr. Rawlins who served as engineer of design and construction on the new Catawba River Raw Water Pumping Station, and the enlargement of the Charlotte Filter Plant, described these recent improvements involving installation of three stage mechanical mixing and flocculation, and doubling the size of the filter plant.

Mechanical mix and flocculation in three stages involves flash mix by diffused air followed by an intermediate mechanical (paddle) mix and, finally, a slow speed Dorr Flocculator followed by 4 hours of settling. Features of filter design include corrosion proof Wheeler type false bottoms and under water lighting to

National Director
Paul W. Frisk
Enka Corp.
Enka, N. C.

National Director Elect
Dr. J. W. Kellogg
Ass't. Director of State Labs.
Raleigh, N. C.

better observe floc quality and filter wash. The pipe gallery is divided into two levels—influent and effluent levels. Wash valves are of the solid wedge type. Pre- and post-chlorination is provided, with ammoniation of raw or final water at will. Carbon is applied in the flocculation stage and also as batch application to the filters, as desired. Chemical feed lines are of 2.5" rubber hose. The high service pump station was enlarged to 27. mgd. capacity and stand-by twin-gas-engine driven units installed. With a 3 mgd. capacity baffled clear water well it is possible to practice super and dechlorination should such become desirable. The Southeastern Construction Co. were the general contractors and Roberts Filter Company sub-contractors.

(The several improvements have been covered in an article by Mr. Rawlins describing the Charlotte plant in the March 1939 issue of this magazine. For the several interesting features and details see his article.—ED.)

"The Catawba Pumping Station"—
—by J. L. GREENLEE, Ass't. Sup't., Water Department, Charlotte, N. C.

Mr. Greenlee enumerated the major improvements made to the raw water pumping station, located 9 miles from the filter plant on the Catawba River, in which replacements of obsolete pumps and instal-

Charlotte Hosts

Jas. B. Marshall City Engr.—Manager.

Wm. E. Vest Sup't. Water & Sewerage.

lation of a new pumping main had saved Charlotte many dollars. Features include separate suction line to every pump, twin discharge headers, cone-type valves on each discharge and a cone-type surge suppressor. The latter had proved an effective device since adjustments had been made on a cut and try basis for timing of start of closure and speed of closing by a unique method. The three new pump units have 8, 10 and 12 mgd. capacities and one old 5 mgd. unit is retained for standby service. Between the raw water storage reservoir of 60 mg. capacity on the original 24" C. I. line from pumping station to filter plant, a parallel 30" main had been laid the 5.2 miles. The station is subject to operation by remote control, being thoroughly equipped with safety devices and a 5 cabinet control panel on the front of which the highest voltage is 110 volts.

The combination of replacement of obsolete pumps and the new 30" line had made it possible to pump almost twice the water per KWH.—namely, 1260 as against 665 gallons, or 89.4% increase due to higher pump efficiencies and lowered friction head.

"Some Highlights Pertaining to Water Supply Developments and Trends"—by LINN H. ENSLOW, Editor, WATER WORKS AND SEWERAGE, New York City.

An extemporaneous running talk by Mr. Enslow was made in conjunction with numerous lantern slides picturing interesting developments in water supply practices and equipment.

In commenting on the high cost of continuing to operate obsolete equipment, on the grounds that it is still in good condition, Mr. Enslow pointed to the accomplishments at Charlotte as an excellent example of distinguishing between *useful* life and *profitable* life of such equipment.

In respect to filtration practices, mechanical mix and controlled flocculation continued to receive the spotlight in recognizing the value of adequate raw-water preparation. Trends in filtration were to higher rates, cleaner and more nearly sterile filter beds, and improved corrosion resistant filter bottoms. In the last direction the Wheeler type bottom with porcelain distributing balls had gone into a number of recent plants as had the false bottoms of porous diffuser plates, the latter eliminating the troublesome gravel beds. In filter bed cleansing the high-rate scheme

Programmers

Prof. W. H. Hall, Duke University, Durham. (Chairman of the Program Committee.)

L. I. Lassiter, Sup't. Filtr., Wilmington. (President of N. C. Water Operators' Association.)

Geo. S. Rawlins, Cons. Engr., Charlotte. (Former Ass't. City Engr., had charge of recent enlargement of Charlotte Filter Plant and Pumping Stations.)

had proved disappointing and the trend was markedly to minimum upflow (floatation) rates, and maximum sand scour by water jetting—such as the Baylis Surface Wash and the newer Palmer Revolving "Filter Sweep" which had been giving such a good account of itself in several installations. [More concerning the "Filter Survey" appears later under the Round Table on Problems in Water Treatment."—ED.]

In the matter of effective raw water preparation and laboratory control by flocculation tests, what to the eye might appear to be the most *effectively* flocculated water might not prove the the most *efficiently* flocculated water. Evidence of this was to be found in experiences at Richmond, Va., wherein the control scheme developed recently incorporates comparative rates of filtration of laboratory flocculated water samples. Rates of filtration and rapidity of laboratory filter chokage, (in combination with clarity of filtrate) provides the "Index of Filtrability" on which the dosage of coagulant applied in plant operation is now based, frequently with coagulant economy resulting.

Discussing progress in corrosion control, Mr. Enslow cited the interesting recent developments involving the use of hexametaphosphate to prevent rapid deposition of calcium carbonate from lime treated water and likewise, in lime treatment, for maintaining a high pH value throughout the system; also the use of hexametaphosphate to suppress corrosion even at low pH values. For small supplies the limestone contact bed method of producing a balanced water, without chemical application and control requirements, seemed overall the most practical and fool-proof scheme available. This led to a brief description of the Enslow Continuous Stability Indicator (a calcium carbonate contact bed on a laboratory scale) and its adaptation in determining the corrosivity or encrusting qualities of a water and in controlling the treatment to bring it into balance. At this point cathodic protection of water mains, standpipes and tanks was described and its recent performance in its application to elevated steel tanks indicated the scheme to be effective and economical.

Mr. Enslow then recounted some of the many uses for compressed air in water works operation, amongst these being the effective emptying of water mains in making repairs, the

J. H. Henderlite City Chemist Gastonia, N. C. (New Vice-Chairman.)

W. H. Booker Ch. Engr., State Dep't. of Health Raleigh, N. C.

air "shooting" of troublesome dead ends to clear them of pressure killing deposits and bad tasting water, the "shooting" of service lines, the operation of air motors for various purposes such as operating large tapping machines, opening valves, etc.

Programmers

J. L. Greenlee, Ass't. Sup't., Charlotte Water Dep't.
Bruce Harkness, Tate Pipe Linings, Inc., Andover, Mass. (Rejuvenated some mains for Charleston laid in 1880.)
W. J. Parks, Sup't. Watersheds, Asheville, N. C.

Pertaining to developments in connection with water mains, two were of particular interest. The first American job of cleaning and cement lining of old water mains in place by the Tate process had been completed in Charleston, S. C., with results even surpassing those anticipated. The second had been the introduction of sanitary rubber jointing strips, to take the place of dirty yarn in making poured bell and spigot joints.

Other developments briefly reviewed included effective and simple schemes of improving "Public Relations," water main cleaning, and meter shop practices and equipment.

Sewerage Topics

"The Digestion of Keir Liquor"—by R. S. PHILLIPS, Chief Chemist, Department of Water and Sewerage, Durham, N. C.

Mr. Phillips' paper constituted a report of findings in a study made to determine to what extent the highly caustic and organic Keir liquors from textile mills—the most troublesome waste from the textile industry—might be disposed of by digestion along the sewage sludge.

Applications of 2.5% and 5% Keir liquor to digesting sludge produced increased yields of gas containing 74% methane. In 10 days digestion was 70 to 75% complete, reaching 90% only after 40 days, as measured by B.O.D. values of the digesting mixtures. Temperatures above 80° F. seemed to have little or no value in speeding digestion.

In the conclusions reached, a mixture of 4 to 5 volumes of sludge to 1 volume of Keir liquor appeared to be safe practice to maintain digester balance and gas of quality similar to that from sludge alone. In matter of time, 20 days at 80° F. seemed ample to reduce the organic content by 80%, or 10 days for a 70% reduction.

Operating Problems In Sewage Treatment

(A Round Table)

The Round Table on "Operating Problems at Sewage Treatment Plants" was conducted by *Dr. H. G. Baity,* Professor of Sanitary Engineering, University of North Carolina.

Filter Fly Control Methods

George Moore, Sup't of Water and Sewerage, Albemarle, N. C., reported routine flooding of beds at two-week intervals, holding the beds full for 24 to 36 hours before dumping. Also employed chlorination to reach the areas where slime deposits accumulated on the top stone and side walls. Similar results were reported for the Spartanburg, S. C., plant, where chlorine has been employed for odor and fly control.

L. H. Enslow, being asked for recommendation of best method, stated that where permissible flooding at intervals of 12 days to two weeks appeared the most effective and economical remedy. When flooding was not permissible, application of chlorine in high dosages (3ppm. residual chlorine) to night flows had proved next in order of the preferred methods.

In flooding, Mr. Enslow said that there was one drawback—namely, the cutting off of oxygen supply and the ill effects of septic action on the nitrifying portions of the bed which, incidentally, stood submerged the longest period. Operators practicing flooding had on this account found chlorination of the settled sewage during bed filling periods to be helpful in retarding biological activity and resulting septization.

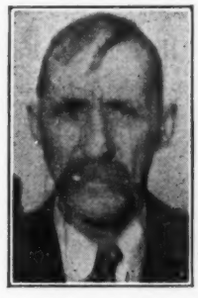
Sludge Conditioning for Filtration

E. H. Moss, Sup't of Treatment Plants, Greenboro, N. C., reporting on two installations, finds a continuous mix in baffled chambers providing 15-minute maximum period to be superior to longer mixing.

In dewatering a chemically precipitated sludge in a plant treating mixed sewage and textile mill wastes, Mr. Moss reported that it was extremely difficult to produce a filter cake of moisture content under 80%, regardless of the amount of sludge conditioner added. The sludge containing 3% solids is thickened to 4 to 4.5% in elutriation tanks.

In the activated sludge process that followed chemical precipitation bulking troubles had been corrected by giving over ¼ of the aeration units to sludge re-aeration. Interestingly, bulking had been checked by this procedure even though the mixed liquor revealed no dissolved oxygen present.

C. E. Rhyne Sup't., Water, Light & Sewerage Gastonia, N. C.



T. S. Price, Op'r. Hickory, N. C. (Possessor of handsomest mustaches thar abouts.)

J. H. Henderlite, City Chemist, Gastonia, N. C., had switched from the earlier batch method to a short period continuous mix (5 minutes) to save 10% conditioner (ferric-chloride), and secure other advantages including elimination of recirculation of conditioned sludge.

Professor Baity recommended more consideration to sludge conditioning in connection with dewatering on open sand beds. Reasonable dosages of coagulants, with little or no mixing period, amazingly increased the bed capacity and rapidity of free water separation.

(1) Jas. E. Gibson, Gen'l. Mgr., Charleston, S. C., Water Dep't. and A. S. Robinson, Nat'l. Tube Co., Pittsburgh, Pa.; (2) Ed. M. Johnson, Ass't. City Engr., Raleigh, N. C., and J. D. Lester, City Chemist, Rock Hill, S. C.; (3) The President of A. W. W. A. —J. Arthur Jensen, Sup't. Minneapolis Water Dep't., with Walter A. Hersey, President, Hersey Meter Co., Boston, Mass.; (4) "Art." Wigley, Phipps & Bird, Inc., Richmond, Va., and Max G. Howe, Sup't. of Water, Union, S. C.; (5) A. P. Rudder, W. & T. Co., Greensboro, N. C., and Jim Ivey, Mathieson Alkali Wks., Charlotte.

(1) D. R. Taylor, Plant Sup't. Roanoke, Va., Water Dep't., and John R. Purser, Sales Representative, DeLaval Pumps and Builders Iron Foundry, Charlotte; (2) Z. N. Holler, Mathieson Alkali Wks., Greensboro, N. C., and J. C. Martin, Sup't. of Water and Sewerage, Tarboro, N. C.; (3) The Salisbury Contingent, A. C. Beaver, Foreman, E. S. Alexander, Chief Filter Operator, and D. A. Atwell, Ass't. City Engr.; (4) W. F. McAuly, (Columbia, S. C.) and Frank Taylor (Asheville, N. C.), of Pittsburgh Equitable Meter Co.; (5) "Sam" Gilbert, Link Belt Co., Philadelphia, Pa., and Lawrence Weston of L. A. Weston Co., Adams, Mass.

Regulating Industrial Wastes Discharge to Sewers

Of methods employed in bringing about more uniform conditions at sewage plants receiving industrial sewage, storage and gradual bleeding out of the composited wastes to the sewer seemed the most effective remedy. It was pointed out by Ralph Porges, Investigator for the Textile Foundation, that some dyes should be excluded. Others, if diluted, could be proportionately discharged in step with changing domestic sewage flow to the treatment plant. Mr. Moss reported that manual control of holding tank bleeding had proved superior to automatic bleeding. To preclude process upsets it had been necessary to apply acid at the Greensboro treatment works to adjust pH values, the latter being taken at 30-minute intervals.

Mr. Henderlite, reported holding tanks helpful at Gastonia, when such were effectively controlled by the mills.

Water Super-Chlorination

"Super-Chlorination in Taste and Odor Control" — by A. E. GRIFFIN, Chemist, Wallace and Tiernan Co., Newark, N. J.

Mr. Griffin showed numerous graphs in the form of lantern slides to picture the behavior of typical waters when gradually increased chlorine dosages are applied in order to reach the so-called "oxidation point." These graphs pictured clearly the intensification of tastes and odors with minor chlorine dosages and, hereafter, the "break-point" above which tastes and odors are destroyed. Apparently the explanation is found in the burning up process of wet oxidation, secured through the release of nascent oxygen when the excess of "free-chlorine" reaches a concentration sufficient to produce the well known reaction $H_2O + Cl_2 = 2H\ Cl + O$.

Mr. Griffin then reviewed a few case histories in which super-chlorination practice at several plants had proved efficacious as a taste and odor remedy. He cited the outstanding experience of Tyler, Texas, involving pre-chlorination at rates up to 6.8 ppm. (lower in winter) to maintain not less than an 0.8 ppm. residual at the filters. The residual in the effluent (plus a secondary dosage) was converted to chloramines by ammoniation. Somewhat startling was the fact that on top of such drastic treatment as much as 2 ppm. chlorine in the form of chloramines could be delivered into the mains without complaint. In flushing mains it had been noted that such treatment apparently loosened many tubercles from the pipe walls, which for a period constituted something of a nuisance.

Jas. C. Parker, Sup't. of Works, Elizabeth City, N. C.
L. L. Hedgepeth, Mgr. Technical Service, Penna. Salt Mfg. Co.
Wm. C. Olsen, Cons. Engr., Raleigh, N. C.

Sandusky, Ohio, had benefited from 3 to 5 ppm. chlorine to the raw water to maintain a residual of 0.2 ppm. in the filter effluent. Reading, Penna. — another noteworthy example, added 5 ppm. to the raw water in the supply line to the filter plant. After a 2-hour flow period (contact) the 1.5 to 2 ppm. residual reaching the plant is "mopped up" by the ferrous sulphate (copperas) added as the coagulant, thereby, in part converted to "chlorinated copperas" while doing a dechlorinating job.

On a semi-plant scale at Dallas, Texas, a dosage of 12 ppm. had been required to cut a threshold odor value of 175 or more down to 50, which was effectively removed by powdered carbon thereafter. Anderson, Indiana, and the outstanding case of Waterford, N. Y. (see September, 1939, issue of this magazine for experiences recounted by Supt. R. G. Yaxley) were other cases cited.

In reply to questions, Mr. Griffin stated that a contact period of less than one hour should not be expected to yield results, and that economy and greater certainty came from contact periods of 3 hours and longer.

"Mixing Chambers and Flocculators"—by L. L. HEDGEPETH, Manager, Technical Service, Pennsylvania Salt Mfg. Company, Philadelphia, Pa.

Introducing his topic by the pithy remark that "There can be little less consistent than an alum floc and some women-folk", Mr. Hedgepeth set about to define coagulation and flocculation as starting with effective dispersion (flash mix) followed by fog formation (floc nuclei), then coagulation into readily visible particles and eventually agglomeration into settleable masses. The greater the number of collisions of the floc nuclei the more rapid and effective the floc mass-formation. Therefore, mixing and flocculating devices and processes best developing these important steps in sequence, without omitting any one, proved on the whole the most effective device for properly conditioning water.

Mr. Hedgepeth, with a background of operating experience and wide opportunity of observation since, proved capable of contributing a comprehensive description and discussion of 5 types of mixing, coagulating and flocculating devices — (1) Baffled chambers, providing velocities between 0.5 and 1.5 ft./sec., with periods of 30 minutes upwards; (2) Spiral flow chambers; (3) Compressed air agitation, involving 10 to 15-minute period and 1/14 cu. ft. of air per gallon; (4) The hydraulic-jump, providing 1 minute contact and requiring 2 ft. of head. (Cleveland, Ohio, experiences had, however, indicated superiority of the baffled chamber); (5) Mechanical flocculators of the slow revolving paddle type, following a rapid mix.

Discussing the last named in some detail, Mr. Hedgepeth named the

power requirement at 3 to 6 KWH. per million; peripheral speed of paddles at under 2 ft./min. at 1 to 3 rpm., and so designed as to produce a gradually decelerated floc movement through the liquid. This history of the modern horizontal wheel mechanical flocculator had proved a highly satisfactory one since its development at Richmond, Va., where it had cut the coagulant dosage almost in half to save $23,000 annually.

A discussor pointed out that the flocculator of the Richmond type installed at the Canton, N. C., plant of the Champion Fiber Co. had reduced the coagulant dosage by better than 80%.

Problems in Water Treatment

(A Round Table)

The operator's Round Table on "Problems in Water Treatment" was ably conducted by *P. W. Frisk*, Chemist, Enka Corp., Enka, N. C.

Protection of Surface Sources—introduced by *W. F. Parks., Jr.*, Sup't of Water Sheds, Asheville, N. C., revealed some of his problems on the 20,000-acre wholly city owned water-shed. He concluded the day of water-shed ownership as sufficient protection was vanishing before the march of the automobile. He then cited the fact that the new scenic Blue Ridge Parkway was to traverse the previously uninhabited Asheville shed for 12 miles. The effect on water quality was to be watched closely by sampling surveys made three times weekly. It was his thought that filtration was a coming necessity for Asheville as the price of the "March of Man" across North Carolina's "Land of the Sky."

Keeping Salt Water Out of a Supply—proved an interesting history of experiences with salt water incursions upstream to the intake of Wilmington's (N. C.) supply. The story told by L. I. Lassiter, City Chemist, related the removal of the intake to another stream in 1923 to avoid a recurrence of the 3,000 ppm. Cl. in 1919. After trying swinging type tide-gates and abandoning them in 1934, the present scheme involved a dyked off section of a creek which served as a raw water reservoir into which water is admitted during first stages of rising tides and watching chloride concentration during filling operations. By this scheme the normal chloride content of 50 to 60 ppm. could be maintained. In reply to a question he stated that complaints in Wilmington do not start at less than 150 ppm. but were heard at little above that.

"Supers"

D. W. Thornton, Hamlet, N. C.
J. E. Gibson, Charleston, S. C. (Pioneered *with cement lined C. I. pipes in* 1922, *and now first with old mains cement lined in place in America.)*
W. O. Mann, Silver City, N. C.

Water Conditioning for Rug Mills was the problem of WAYMON SMITH, Sup't of Water Works, Leaksville, N. C., charged with producing a water satisfactory for a major industry—rug manufacture—at Leaksville. He had found it necessary to provide double coagulation, the first stage being followed by 45 minutes settling, at which point a secondary floc is formed by adding nothing but soda-ash to raise the pH value to 7. Thereby a wholly satisfactory water had been produced for dyeing and rug washing.

In the discussion which followed, the question of soda-ash vs. lime came up. It seemed desirable to employ lime for economy sake, but resulting hardness increase was undesirable in industrial supply. Some thought that lime caused floc peptization more than did soda ash. In the end a constructive suggestion was made. If lime be substituted for the soda-ash only in part a happy medium could be struck between costs and permissible hardness increase which would likely not be noticed if the lime substitution be gradually done.

Surface Wash Solved a Problem for F. G. DOGGETT, City Engineer, Mt. Airy, N. C., who told of his difficulties with coated filter sand resembling black "fish-roe", productive of mud-balls and generally dirty beds. In WATER WORKS AND SEWERAGE of October, 1938, he had read about the revolving Palmer "Filter Sweep" developed at Erie, Pa., to secure bed agitation and sand scour. It looked good to him and he had immediately set about designing and building similar units for the Mt. Airy filters. His efforts having met with such success, Mr. Doggett brought along parts of the Mt. Airy pattern of the "Filter Sweep" to describe and display. Operating the sweep to provide 150 gpm. of surface wash, supplemented by 100 gpm. of up flow-wash, had produced remarkable results, returning the dirty sand to the condition of absolutely clean sand. Now the Sweep is operated only 3 to 4 minutes weekly, which seems sufficient to maintain the bed in good condition.

E. F. DUGGER, Manager, Newport News, Va., Water Department, reported that at his plant two Palmer Sweeps had been installed with very satisfactory results. Noticeable had been the increase in length of filter runs, 20 hours having been raised to 82 hours as the result of the combination of clean beds and a top layer of Anthrafilt 8 to 10 inches deep. Mr. Dugger thought that it should be pointed out that Mr. Palmer, an operator in the Erie, Pa., Filter

Round Tablers

Left to Right—L. I. Lassiter, Sup't. Filtration (Wilmington), and Wayman Smith, Sup't. of Water (Leaksville) have had their turn and are listening to F. G. Doggett, City Engr. (Mt. Airy) explain the Filter Sweep installed in Mt. Airy filters. Chairman P. W. Frisk (center) looks with considerable interest at Doggett's modification of Palmer's effective invention at Erie, Pa.

(1) H. C. Erwin, Hersey Meter Co., Atlanta; (2) F. M. Campbell, Sup't. of Maintenance, Asheville; (3) Willis Holding, Sup't. Filtration, Raleigh; (4) J. Houston McClane, Hercules Powder Co., Atlanta; (5) "Mac" Bingley, The Dorr Co., Richmond; (6) J. L. Perkins, Director Public Utilities, High Point; (7) F. L. Bunker, Chicago Pump Co., Charlotte; (8) J. P. Penn, Plant Sup't., Henderson; (9) E. H. Ingle, President, Electro Rust-Proofing Co., Dayton, O.; (10) Charlie Thomas, Mgr. of Sales, Roberts Filter Co., Darby, Pa.

Plant, had spent considerable time and thought to perfecting his worthy device on which he had secured patent protection, and was now in a position to supply the Palmer Sweep through the Palmer Filter Engineering Co., established in Erie to manufacture and market it. (For details concerning the Palmer Filter Sweep and its performance, see the October, 1938, issue of this magazine—also page 303 of the August, 1939, issue.

Lining Pipes in Place

"Lining Pipes in Place" — by BRUCE HARKNESS, Tate Pipe Linings, Inc., Andover, Mass.

Mr. Harkness, with the aid of moving pictures in color, described the cleaning and lining (in place) of old Charleston, S. C., mains with cement mortar by the Tate Process, which has been described by Mr. Harkness in the March, 1938, issue of this magazine.

The Charleston project involved the lining of 12,000 ft. of 4, 6 and 8-inch distribution mains, some of which had been in service since 1880. The procedure consisted of removing from service the section to be lined and disconnecting all laterals or services thereon. A cable is threaded through and the "cutter" is then winched through for several passes, at a speed of about 30 ft./min. Then follows the steel brushes which remove all scarified encrustation and tubercules. Finally the cleaning job is completed by winching through a rubber cupped double plunger to insure a clean smooth wall. This operation is repeated until no further material comes out ahead of the plunger. The lining operation consists of filling about 80 ft. of pipe run by ramming in cement mortar, previously prepared to exact consistency for the process. The mortar spreading and squeezing mandrel is slowly winched through (12 ft./min. travel) from behind the fairly exactly calculated volume of mortar charge for providing a thickness of 3/16 to ¼ in. on the length of section being lined. The mandrel is a bullet nozed hollow cylinder 8 inches long, having a taper toward the rear. Thus the lining is highly compressed against the pipe walls and the free water is squeezed out through dehydrating perforations in the tail-piece or skirt of the mandrel. With the water goes much of the soluble lime. Each of the cleaning and lining instruments involved, were pictured and described in detail, which with the colored movie made a distinctively vivid picture of the complete operation.

Then Mr. Harkness presented the "proof of the pudding". Thus, too, the form of available data revealing what the lining project had produced in the way of returning badly tuberculated mains to their original capacities, based on friction coefficients "C" taken by the Charleston Water Department before and since lining. The "C" values quoted are based on nominal diameter of cleaned pipes rather than on actual diameters after applying the lining which reduces the nominal diameter by 6/16th to ½ inch—i.e., by twice the lining thickness.

Normal Diameter	"C" Values Before	and Now
8"	53	112
8"	51	128
6"	44	113
6"	50	117
4"	33	81
4"	37	88*

* "C" when calculated on actual diameter of 4" lined pipe proved to be that of shop lined pipes—namely, 140.5.

Mr. Harkness cited the condition of a section of cement lined pipe laid in Charleston in 1922 and dug up from a "hot-spot" recently. The pipe had suffered due to exterior graphitization of the iron, whereas the cement lining was found intact and in good condition.

In reply to the many questions, some of the replies follow:

Not less than ¼ inch lining should be provided when lining in place, whereas shop lining permitted ⅛ to 3/16 inch linings. On the average, only 2 to 3 cu.ft. of mortar in excess of calculated charge is wasted on each run of pipe.

Service connection plugs were removed before final hardening of the lining which then could be cut out with a pocket knife. Drilling cement lined pipes, after a period of service, had been successfully done with drill bits ground to 60 degrees.

For lining in place, sloping mains on grades up to 1 ft. in 5 had been successfully lined.

Experience in Australia had shown that after 5 year service of lined mains the "C" value had dropped but 5 points—i.e., from 145 to 140.

Two sections of between 300 and 400 ft. runs could be cleaned and lined in a working day.

H. E. BECKWITH, Engineer, The Pitometer Co., speaking from experience over a number of years in evaluating pipe lines, pointed to the decided wisdom of employing nothing but lined pipes in the future.

Exhibitors

The following 26 firms were represented in the materials and equipment exhibit:

Activated Alum Corp.
American City.
Badger Meter Co.
Builders Iron Foundry.
Chicago Pump Co.
DeLaval Steam Turbine Co.
Dixie Culvert & Metal Co.
Everson Filter Co.
Electro Rust-Proofing Co.
W. & L. E. Gurley.
Hersey Mfg. Co.
Hays Mfg. Co.
International Filter Co.
Johns-Manville.*
Mueller Co.
Neptune Meter Co.
National Meter Co.
J. R. Purser, Sales Engr.
Permutit Co.
Pittsburgh Equitable Meter Co.
A. P. Smith Mfg. Co.
L. A. Salomon & Bros.
R. D. Wood.
Wallace & Tiernan Co.
Water Works Engineering.
Water Works and Sewerage.

*In a pipe-jointing speed contest, which attracted attention at the Johns-Manville booth, W. F. Mungo, Foreman, Charlotte Water Dept., made the best time by completing a joint in 1 minute and 4/5 second, to win the prize—a handsome fountain pen and pencil set.

METERS AND MAINTENANCE

Featured at December Meeting of N.E.W.W.A.— Chemists Hold Forth at Harvard Laboratories

The President
P. A. Shaw, Sup't.
Manchester, N. H.

A Report by ROGER W. ESTY
Sup't., Water Department
DANVERS, MASS.

APPROXIMATELY 200 members and guests attended the December meeting of the New England Water Works Association on the 21st at Hotel Statler in Boston.

The lively Superintendents' Session took up the matter of "Meters —Their Selection and Maintenance". And, after that a spirited discussion of the question of inspection and approval of plumbing and piping on consumers premises by Water Departments.

The Chemist's Session, held in the Sanitary Engineering Laboratories of Harvard University, featured the topic of "Tools of the Chemist."

Preceding the usual morning Round Table Session *Professor George E. Russell* of the Massachusetts Institute of Technology gave a blackboard lecture on methods of testing the flow of water in pipe lines and also the method of determining the proper thicknesses that various metals should have to withstand definite internal pressures. These lectures constitute a series in the "Water Works School."

Supt's. Round Table

Chairman—S. H. Taylor, Sup't., Water Dep't., New Bedford, Mass.

The morning Round Table on "Meter Maintenance," which developed into one of the most interesting meetings that these morning sessions have produced, was most effectively conducted by Mr. Taylor.

Horace J. Cooke, Sup't., Auburn, Me., Water Works, started the session off by asking why all meters were not made to read in gallons instead of cubic feeet. Mr. Lufkin, New England Manager, National Meter Co., stated he didn't know how it got started that way but said for the past 50 years some would request that the meters should read in gallons, while others were just as emphatic for having them read in cubic feet. The only part of the mechanism that need be changed to change over from one to the other was in the intermediate gears.

Round Table Chairmen

Stephen H. Taylor
New Bedford, Mass.

Prof. Edw. H. Moore
Harvard University

Chairman Taylor discussed the merits of the round dial and straight reading registers and apparently 95% of the meters being delivered in New England were of the straight reading type.

Donald Calderwood, Engineer of the Pennichuck Water Works, Nashua, N. H., stated that his experience with straight reading registers were better than with the round reading type. The simplicity of reading was advantageous both to the meter reader and to the customer. To this was added the opinions of E. J. Titcomb, Sup't. of the Rockdale Water Works, *Fred J. Remy,* General Manager Portland Water District, Portland, Maine, and *Henry Gidley,* Sup't. Fairhaven Water District, all voicing their preference for straight reading registers.

Mr. Stewart, representative of the Pittsburgh Equitable Meter Co., discussed the advantages of the oil enclosed gear train. Even if it only kept out the grit and dirt the life of the gears would be considerably longer.

Roger W. Esty, Sup't. of the Danvers Water Works, stated that from his experience the gear trains that were not enclosed would wear out in the Danvers water at about 3 million cubic feet, and that he has a 5/8" oil enclosed gear train still going strong at 120,000,000 cubic feet.

Mr. Taylor stated that they have 17,339 meters in New Bedford and that they attempt to test about 10% of them each year. He felt that a meter should be tested every 7 to 8 years.

Michael E. Quirk, Sup't. Peabody Water Works, spoke about the difficulty he was having in obtaining a sufficient amount of money to purchase necessary repair parts for meters. In a great many instances he had found it more economical to purchase a new meter than to buy the necessary repair parts. Many of Peabody's meters are 35 to 40 years old, some of which are beyond economical repair cost.

Problem of Large Meter Testing

Mr. George G. Bean, Sup't. Exeter Water Works, Exeter, N. H., had a problem on testing large meters because in doing so it inconvenienced the customer and required extra hours for his men to do the work. Mr. Taylor exhibited a picture of how it is done in New Bedford by placing a by-pass around the meter. With the proper number of gate valves the test is made during regular hours without interfering with the supply to the customer.

Nelson Boardman, Ass't. Sup't., Danvers Water Works, said that they had a similar meter setting in Danvers and that he tested all of their meters from 1½" to 8" in the field. He felt it was a needless expense to provide testing equipment to test 4, 6, or 8" meters in the shop.

Furthermore, there was nothing like testing them under actual conditions in the field. How often would a superintendent take out an 8" meter and bring it back to the shop and test it? Not often. Danvers tests all of the large meters in service twice a year.

Robert T. Ferguson, Hersey Meter Manufacturing Co., said that they had provided tappings on all large meters so that they could be tested in service. He also favored volumetric testing over scale (weight) testing and said the trend today was toward volumetric testing.

Fred E. Smith
Cambridge, Mass.

Horace J. Cook
Auburn, Me.

This brought out considerable discussion regarding the merits of the two methods (volume vs. weight) and much valuable information was obtained by those in attendance.

Mr. Allen M. Symonds of Milbury, Mass., Manager of several private companies, presented some very valuable information on the testing of meters, costs of parts, labor and the amount of additional revenue received after testing.

He has a machine that tests 8 meters at a time, by volume. They plan to test 9,000 meters in two years. To date he has tested 3,017 meters with an increase of $5,028 in revenue, equivalent to $1.66 per meter. On a group of 30 small meters he found an increase of $2.52 per meter per quarter, representing the largest increase obtained on a group picked at random.

Mr. Taylor reported that the labor costs for testing various size meters were as follows in New Bedford:

Units	Size	Avg. Cost
595	1"	$1.60
519	¾"	1.94
395	⅝"	2.03

If the cost for repair parts exceeded $3.50 the meter is scrapped automatically.

William P. Melley, Sup't. of Milton Water Works, stated that he has many requests to test a meter when the customer receives a large bill. Now a moderate charge is made for this service. Some superintendents do it gratis, others make a charge of one or two dollars.

Considerable discussion arose over the question of who should own the meter—utility or customer?

Henry Gidley, Sup't. Fairhaven Water Co., stated that the consumer owned the meter but his company repaired them. *Mr. Quirk* of Peabody stated that the small meters were owned by the city but *all* large meters were owned by the manufacturers.

Mr. Calderwood stated that in New Hampshire a state law required that all meters be tested once in 6 years, the meters being owned by the water company.

Mr. Taylor proved to be the undisputed "proprietor" of the greatest number of various makes of meters, for New Bedford could boast 19 "varieties"—good, bad and indifferent.

Shop Methods of Testing

The merits of testing one meter at a time as against several in line brought out a lot of discussion. The manufacturers of meters seemed to advocate tandem testing as the overall preferred method.

The Ford Meter Box Co. are offering a device to test meters at proper rates of flow that is called the "Testerate." Several experiences with it were related. *Mr. Ferguson* (Hersey Co.) stated that the "Testerate" method was a decided step in meter testing procedure and said, jokingly, that this rate indicator is "so sensitive that it will register a drop of water every other Tuesday."

He said the price of materials in the making up of a meter varied and was a decided factor in the ultimate meter. If the water works men wanted a better meter that such a demand should come from them rather than have the manufacturer produce unnecessarily costly meters.

The question as to how a check is kept on meter readers and the number of units read ecah day was answered by Mr. Taylor, who stated that he expects them to read at least 100 per day. They have to report a leak or excessive consumption to occupant of the building and they also have to go back and pick up their "skips." Rainy days they do not read. The accessibility of the meter is a very important factor in the speed of reading and should always be given careful consideration in planning.

Lumping Meter Readings

Some superintendents had been requested to lump all readings of various meters supplying property at several locations but all owned by one owner. *Mr. Cooke* of Auburn treats each meter just as if there was a separate owner. *Mr. Calderwood* of Nashua, operating a private company, treated each meter as if controlled by individual owners. In connection with an industrial plant, *Harry Fuller* of the Portland Water District treated all consumption through the several meters on the property, as one, and gave them the benefit of the sliding scale. However in order to obtain this rate they must pay the full service installation costs of the supply lines.

Mr. Stone, Sup't. of the Northboro Water Works was having the same problem with the charges on several meters supplying the same factory. It was very evident that this was a problem wherein there were sliding scale rate structures in effect. One place had as many as 24 different rates. With one rate this, therefore, does not become a problem.

R. E. Ferguson
Hersey Meter Co.

Don. C.
Calderwood
Nashua, N. H.

Interior Piping and the Water Utility

The last topic on the program, *"The Function of the Water Department in Testing and Inspecting House Water Piping and Fixtures,"* was opened up by *Horace J. Cooke,* Sup't. Auburn (Me.) Water District, who gave a very interesting talk on plumbing hazards found in many homes. A poor service (one corroded), constituted a potential hazard. He stated that if the flow into the building was very poor and water was being supplied to a "three decker," when water was drawn on the first floor, it would siphon back from the upper floors. With some type of fixtures water could be siphoned back into the piping and

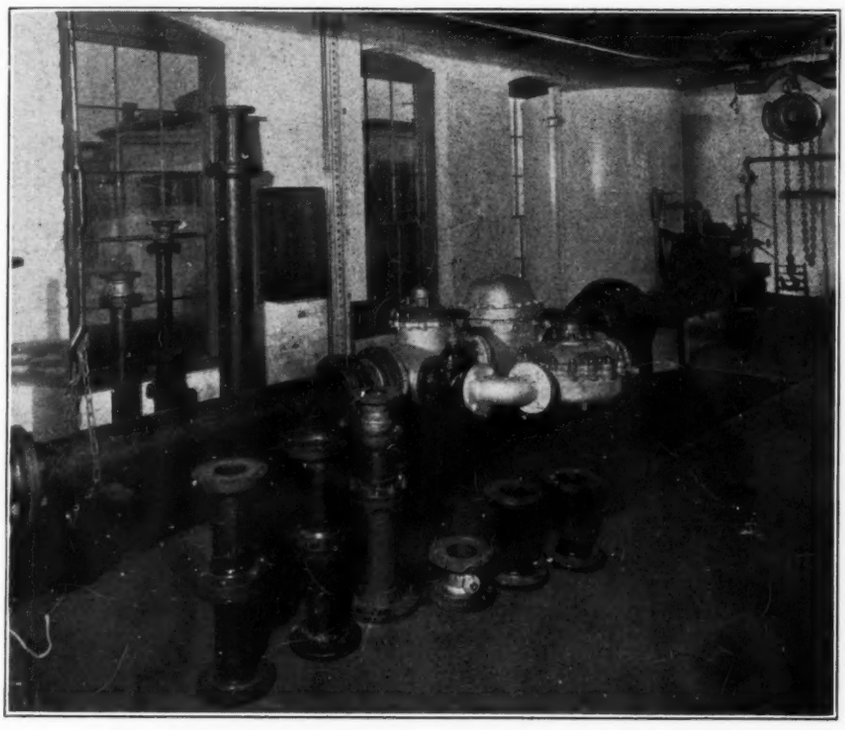
then out through the faucet on the first floor.

Chemists' Round Table

Chairman—Edw. W. Moore, Harvard University.

Topic—Laboratory Equipment.

This topic, of interest to water analysts, was discussed in one of the lecture halls of Harvard School of Sanitary Engineering, and was well attended by chemists from Maine to Connecticut. *Professor Moore* opened the meeting by demonstrating some of Harvard's laboratory equipment. With the classic thermophone invented by *George C. Whipple,* and improved by Professor *G. M. Fair,* by employing an amplifying unit using vacuum tubes, *Professor Moore* was able to produce a brand of static vastly superior to that emanating from our own radio.



New Bedford's Equipment for Making Large Meter Tests
(Hersey 6" Detector Meter in place; adaptors for 3", 4" and 8" meters in foreground. Note chain-hoist and monorail for handling these heavy meters.)

This instrument is used for determining temperatures at various depths, and depends upon resistance naturally introduced into a bimetallic couple lowered into the water.

Next *Professor Moore* demonstrated electric pH meters of the quinhydrone and glass electrode type, stating that he had found the quinhydrone electrode cheaper, and more accurate for values from pH 6.0 to pH 8.5.

He next demonstrated a battery stirrer, built at the Harvard shops, and similar to the Phipps and Byrd type. The Harvard stirrer has been provided with lights projecting Tyndall beams up through the bases of the jars.

Professor C. O. Baird of Northeastern University demonstrated one of the new type Beekman pH meters and Coleman glass electrode. He exhibited prepared curves for color, nitrate, albuminoid ammonia, and turbidity determinations, using the Cenco-Sheard photelometer, and was able to make color determination of the Cambridge raw, filtered and tap water which agreed exactly with the determinations of *Mr. Smith,* Chemist of the Cambridge Filter Plant.

Fred Smith of the Cambridge Filter Plant next showed a Baylis turbidimeter which he has found useful, as his filter beds tend to crack and pass some turbidity as the temperature of the water decreases. By closely watching the turbidity of his filter effluent he is able to determine the proper time to wash the filter. *Mr. Smith* also demonstrated a method of making microphotographs by using a small inexpensive candid type of camera.

A Quebec Colony Counter, for ease and accuracy in making plate counts, was next shown by *Ellis Tarlton* of the Salem-Beverly Filter Plant.

Wayne Damon of the Leominster Filter Plant demonstrated a homemade apparatus for color determinations which made use of tubes 36 inches long, in conjunction with artificial light in a stand to cut off interfering light rays. This apparatus was excellent for exhibition uses to show plant processes to visitors, as well as for accurately reading colors at values as low as 1 to 2 ppm.

Following the demonstration of apparatus by members, *Professor Moore* conducted a tour of the Harvard laboratories showing the batteries of tube filters containing various grades of sand, granular carbon, zeolites, and calcium carbonate, apparatus for determining Stokes law, and gas dispersion, the cold room, the physical and research laboratories, and the students' laboratories where each student has available for individual use, drying ovens, furnaces, stills, distilled water, oxygen, etc. The meeting then adjourned to the Hotel Statler for dinner and the afternoon program.

[For the reporting of the Chemists' Round Table we are indebted to Ellis A. Tarlton, Chemist, Salem-Beverly Filter Plant.]

Afternoon Technical Session

President Shaw, Presiding

In opening the afternoon session following the luncheon, the President announced that the annual convention would be held at Hotel Commodore, New York City, September 23rd-26th, inclusive.

"Comparative Studies of Lactose Broth and Brilliant Green Bile with Cambridge Water," the first paper, was presented in a very interesting manner by Fred E. Smith, Chemist, Cambridge (Mass.) Water Department. Mr. Smith reported a result from parallel tests, involving Brilliant Green Bile and Lactose Broth. Raw, coagulated, filtered and chlorinated water was examined with both media. In the primary tests Brilliant Green Bile yielded more positive results with raw water samples than did Lactose Broth. A slightly inhibitive effect of the newer medium was noted in the examination of coagulated, filtered, and effluent waters when the results were compared with those obtained with the standard Lactose Broth.

As a confirmatory medium the use of secondary Brilliant Green tubes produced results which showed high correlation with the results obtained with standard E.M.B. plates and supplementary procedures. Brilliant Green Bile is used now for all con-

firmatory tests in the Cambridge laboratory.

In all primary tubes of Brilliant Green Bile, producing gas, the presence of coliform organisms was confirmed when subjected to further study. In filtration plant control the use of B.G.B. tubes will provide definite information concerning the condition of plant samples within 48 hours.

The extisting standard procedure is not 100% efficient in the detection of coliform organisms. False presumptives must be re-examined, and the results of examination are not available, therefore, for several days. Although B.G.B. was slightly inhibitive with treated water samples, the medium presents many advantages most useful in laboratory control of water purification.

While the standard procedure has proved worth while in water examination, this fact should not prevent study of its usefulness when other media are available to water laboratories.

The 1939 Drought

Mr. Harvey B. Kennison, District Engineer U. S. Geological Survey of Boston gave an illustrated talk on *"The Drought of 1939."* By various charts the drought of 1939 was compared with the rainfall of other years. From studies, his conclusions were that droughts and wet periods come in cycles, and with a reasonable degree of accuracy it is possible to predict how often these periods will occur. The study of tree rings was interesting and the wet and dry periods could be determined by the width of the spaces between the rings.

Mr. Kennison makes the prediction that at least two more dry years are likely. (In respect to drought period expectancy, the reader will be interested in an article by H. P. Gillette on another page of this issue.) —Ed.

Federal Aid for Small Supplies

Samuel M. Ellsworth, Consulting Engineer of Boston presented a paper on *"Federal Subsidies for Securing Public Water Supplies in Small Towns."*

Mr. Ellsworth said that through Federal aid small towns had at last been enabled to realize a water supply system. Such financial aid had been just the stimulant needed to make small communities realize a golden opportunity of securing for themselves a public water supply. Citing an example — Lanesboro, a small town in the extreme western part of Massachusetts, availed themselves of the Federal money and constructed a system at a cost of $150,200, exclusive of engineering. Due to improved cooperation all along the line, particularly with the government engineers, the work advanced much more rapidly than previously experienced under Federal aid procedure.

The supply was developed from 15 driven wells of 2½" diameter. Cement lined cast iron pipe was installed for permanency and service lines of copper tubing were installed for the same reason. A 300,000 gal. elevated tank cost $16,980 and the pumping station $12,600—the completed job costing $150,200.

At times 190 men were employed on this relatively small project—125 being the average at work.

(We would remind readers that, whereas, P.W.A. aid is no more, funds in aid may still be had through W.P.A. which now favors the "W.P.A.—Contract No. Procedure," and, wherein, the job is let to contract and prosecuted in a regular manner. For details, see WATER WORKS & SEWERAGE for November, 1939, page 423.—Ed.)

CHAS. L. FOX
Appointed General Superintendent Pennsylvania Water Co.

Chas. L. Fox

Chas. L. Fox has been named to succeed the late W. C. Hawley, as General Superintendent of the Pennsylvania Water Company. Mr. Fox has lived all his life in Pittsburgh. He attended the Rensselaer Polytechnic Institute, from which he was graduated with the degree of Civil Engineer. From the group in his graduating class he was picked by Mr. Hawley for the position of Assistant Engineer, and for thirty-seven years since Mr. Fox has been associated with Mr. Hawley in the operation, maintenance and construction of various parts of the plant of the Pennsylvania Water Company.

Mr. Fox is a member of the American Society of Civil Engineers, American Water Works Association and Penna. Water Works Operators Association. Of the last named he was one of the organizers and wears the key of past-president. Last year when the new Western Penna. Section of A.W.W.A. was established, Mr. Fox was elected Chairman of that Section.

"Like Father; Like Son"—so it can be said, "like his late superior of 37 years; like Charlie Fox." And, therewith a succession of two "aces" in the service of the Pennsylvania Water Company.

A Paint Brush Kink

Water works men may think that hammering is rough treatment for a stiff paint brush, but I have discovered that it "works," and works very well.

Not long ago I decided to do a paint job and I found that all of my brushes were as stiff as boards and apparently unusable. Stores were closed and I couldn't buy a new one. I selected the brush I wanted to use, dipped it in turpentine, and attempted the usual method of limbering by going through the motions of painting an old board. But the brush remained stiff and I was getting nowhere.

A hammer happened to be in sight, and it gave me an idea. "Why not hammer the brush?" I did. I hammered it lightly, turning the brush as I hammered so that the paint bond would be broken in every direction, being careful not to hammer hard enough to ruin it.

In a very short time the brush became pliable. The old dry paint was broken up. I then dipped the brush in turpentine again, went through the painting motions on the old board to be sure that it was all right and to remove all loose paint particles, and then went ahead with the painting job. Henceforth stiff brushes will be no problem for me.

SEWER MAINTENANCE

Some Practices at Rockville Centre, L. I., Developed from Experience

By C. GEORGE ANDERSEN
Superintendent
DEP'T. OF SEWERS AND SEWAGE DISPOSAL
ROCKVILLE CENTRE, LONG ISLAND

The Author
(Pres., N. Y. State Sewage Wks. Ass'n.)

IN THE sewerage problems of today the treatment plant and types and design of sewers seem to take the lead. Now, when one considers the investment in sewer lines as the primary structure, providing an indispensable service in the removal and disposal of sewage, we are in general too negligent in the matter of maintenance and operation of sewers for the best interests of the public and efficient functioning of the treatment plant.

At Rockville Centre the writer, like many other men in charge of sewerage systems and sewage treatment, had his problems. The first was the effective and economical treatment of liquid and solids at the treatment works. Then, after catching up on this important phase of the cycle, in looking around it seemed important to face squarely the other sewerage investment amounting to four times as much,—namely, the sewers. In Rockville Centre we have not so many miles of sewers, nor very large ones, but those we have are as important to proper functioning of the entire system as though they were in a metropolis. The sizes range from 8 to 30 inches, and these sewers clog with roots, sand and many other materials.

Sewer Cleaning

Sewer cleaning being one of our problems, after our sewer lines are laid it becomes a necessity to maintain them in good working condition, and we might just as well lay out a program of routine cleaning and maintenance, rather than wait until trouble overtakes us. Continuing and repeated emergency calls, growing out of sewer stoppages, is very costly. In addition to extra expense there results many disgruntled taxpayers, inconvenienced by stoppages and put to added expense, due to their sewer lateral being plugged because of some backage in the main in the street.

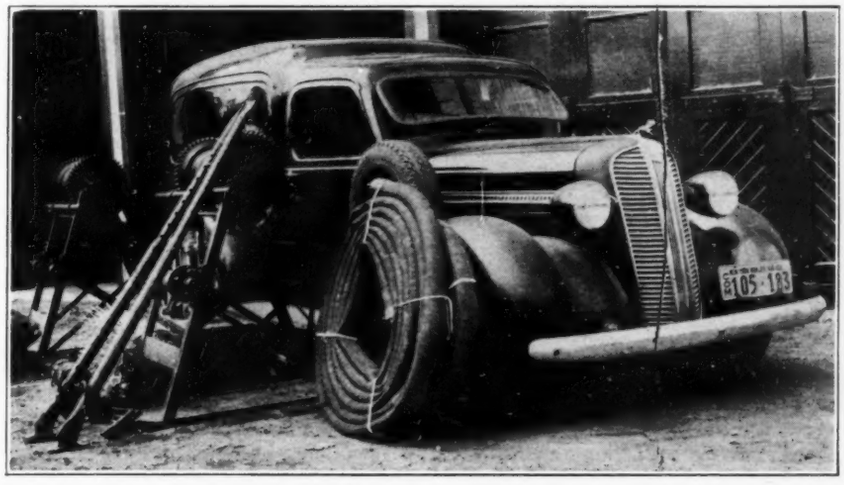
Some Notes on Equipment and Its Effectiveness

For sewer cleaning and removal of roots, there are many types of equipment now available. Flexible steel sewer rods are a recent innovation in such equipment. These rods have an advantage in that the necessity for going down in manholes is eliminated. The rods are made up in three foot lengths, which coupled together make one complete flexible rod that is usually coiled between uses. Wood rods of five foot lengths (coupled together as they are being pushed into the sewer line) also continue in use to some extent. The wood rods, being more rigid than the steel rods, follow a straight line more successfully, but cannot be turned and forced to the extent that the new flexible steels rods can.

The "Turbine" type of sewer cleaning instrument is probably the most positive of all types made today. This device (adjustable to any diameter sewer) is a water powered rotating cutter. In employing the "Turbine", it is necessary to have two winches and cable to draw it through and back between manholes in the line, while the high speed rotating knife blades do a clean job of root cutting and scaping.

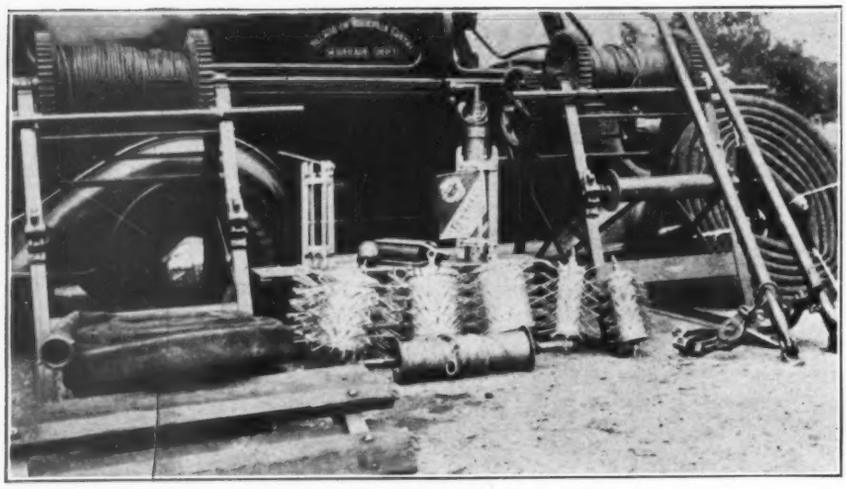
Rods of any kind, which can be used efficiently in making time and mileage when going over an entire sewer system as laid out in a program, are good up to a certain point such as the removal of small deposits and light root growths. On the tougher jobs, such as spots where knob roots have formed (see cut), a more positive applied type of equipment is required. In such cases it becomes necessary to use the "Turbine" cutter, or some similar tool, that will slowly but surely remove the obstruction if it is such as can be cut by steel.

I stress this point, because on one occasion a severe stoppage occurred in an eight inch line. Our Flexible sewer rods were first used, but could



Our Maintenance Truck and Equipment
A 1½ ton unit, which seems a little light. A 2½ ton unit we believe preferable.

* This paper has been prepared from notes used in lecturing before the N. Y. Regional Training School for Sewer Superintendents and Plant Operators—1939.

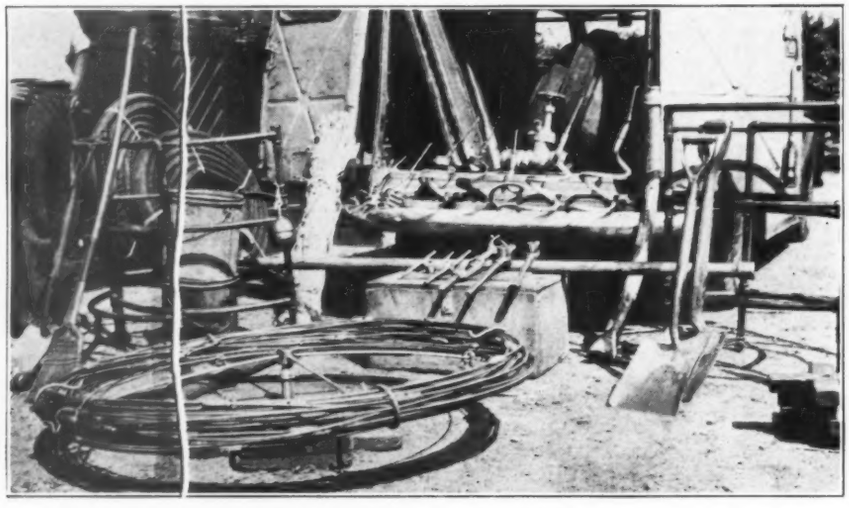


Some of the Equipment

Hose and guards in left foreground; a pair of cable winches, against one which leans cable braces with pulleys inserted in manholes to guide cables. In center, a spool of light threading cable and a set of effective metal scouring brushes (8 to 18 in) supplied by the Turbine Company of Milwaukee. Rear center, on chest containing cutting tools and sleds (6 to 20 in.) for Turbine Cutting heads, is a drag and Turbine Cutter complete for 8 inch jobs.

only give relief to the extent of four inches. That is, the four inch auger-head was the largest tool that could be forced through. The supposition in this case was that the trouble was caused by a broken spur, being replaced by a makeshift stack which extended into the sewer line. Many other suppositions also were expressed, but there is only one thing to do in a case like this (and such is good for experience)—dig it up. This was done and the trouble was, in fact, at a spur. The spur was not at fault, however, but through the joint preceding it a large root had entered. The question was, how to remove it. A hole was cut in the eight inch tile sewer line so that action of the available cutting tools could be observed as it was applied to the root. The root had formed a five finger knob on the top inside of the pipe (see cut). When the Flexible sewer rod with the auger used in eight inch line was applied to the root the tool just jumped back and had no effect. This satisfied me as to the necessity of having a positive applied sewer cleaning cutter, especially for clearing out those very deceiving *top* roots which cannot be removed by auger and do not stop sewage flow until they are definitely a menace in the sewer.

Sand and gravel which have built up around paper, roots and other matter in a sewer, are also a headache. We find that one cannot have *too much* equipment. And, we have also learned that in sewer maintenance different makes of equipment can be used in combination or in sequence to produce very efficient work. Take the case of sand; Flexible steel rods can be used to get an opening through the sand. This constitutes the first important step. Then a cable may be drawn through so as to draw a bullet or tool for loosening and liquifying sand stoppage. Thereafter, the Turbine flusher or cleaning buckets, whichever proves the more efficient, may be used.



Rear of Truck—More Equipment

Flexible sewer rods connected and coiled on revolving wheel stand. Rear of truck, replacement rods and various types and sizes of augers and screw heads (4 to 10 in.) for Flexible rod work; stop valve for controlling pressure from hydrants used in flushing and Turbine operations; Flexible rod man-hole guides, wrenches and ratchets; man-hole guards flag-stands, etc.

Mapping and Program Setting

In setting up our maintenance program, the village map was taken and divided into sections, each section being given a number. In connection with the map, a section book, card index and a daily log book was also established. The section-book is made up of all the sewer sections, showing the sewer lines flush manholes, distances between manholes, etc. Each page (map) covers a separate section (see cut) and the crew operating makes constant use of detail maps in the field. The card index is set up for each section and any conditions found worth remembering for the future is recorded on such cards. The log book maintained to show a complete record of all work done in connection with maintenance and cleaning, carries daily reports showing the number and location of the work section, the type of equipment found needed, number of feet of sewer cleaned, remarks on conditions, number of laborers employed and cost of the job for the day. A specimen page from the current log-book is here reproduced to better picture the type of entries made.

The plan of maintenance is so arranged that at least 78 miles of sewer will be checked once every three years or 26 miles yearly. The actual working time is 5 days per week during the spring and summer months only, involving in all about 150 days per year of maintenance work. The program is planned and timed to run from March 15th to July 1st, the work being resumed in September and terminated on November 15th. The reason for such a schedule is that it eliminates this type of work in the hot weather and also in the cold winter season, the two most disagreeable times to do this work in an efficient manner at least cost.

In the program the business area is done during the month of June, work commencing at 4 A.M. and stopping at noon. At this time of the day there is the minimum of traffic of any kind to hinder the work, therefore all work that is interferred with by traffic can be completed by the time traffic does start to move. The three man operating crew consists of a leader, who must be a reliable industrious individual, and two day laborers. A sewer inspector (or the superintendent) orders sections of work to be done, and likewise supervises the work and sees that adequate records are kept.

In connection with organization, consideration must be given to equipment mentioned and a transport for such. The truck does not have to be an unsightly thing. We use a 1½ ton black panel job, but find that a 2½ ton unit is preferable, as more space is available for the equipment which consists of 1000 feet of hose, manhole and hose guards, Flexible rods and cutting tools, water powered Turbine, cutter, shovels, picks, lantern, flags, tools and emergency first aid.

The operation of the maintenance crew is to put through the sewers a tool that will either indicate a clean sewer, or remove stoppage, or determine the necessity for a more detailed job such as "turbining." In their travels they repair masonry in manholes, pack loose manhole lids that disturb residents because of banging under traffic.

In stopping rattling hanhole lids many things were used which were unsightly on the streets. A gum was then used and served the purpose for a time. The most satisfactory thing to date has been a tape packing called "Tapax." It is laid around the full circumference of the manhole lid seat, after thoroughly scraping and brushing it clean.

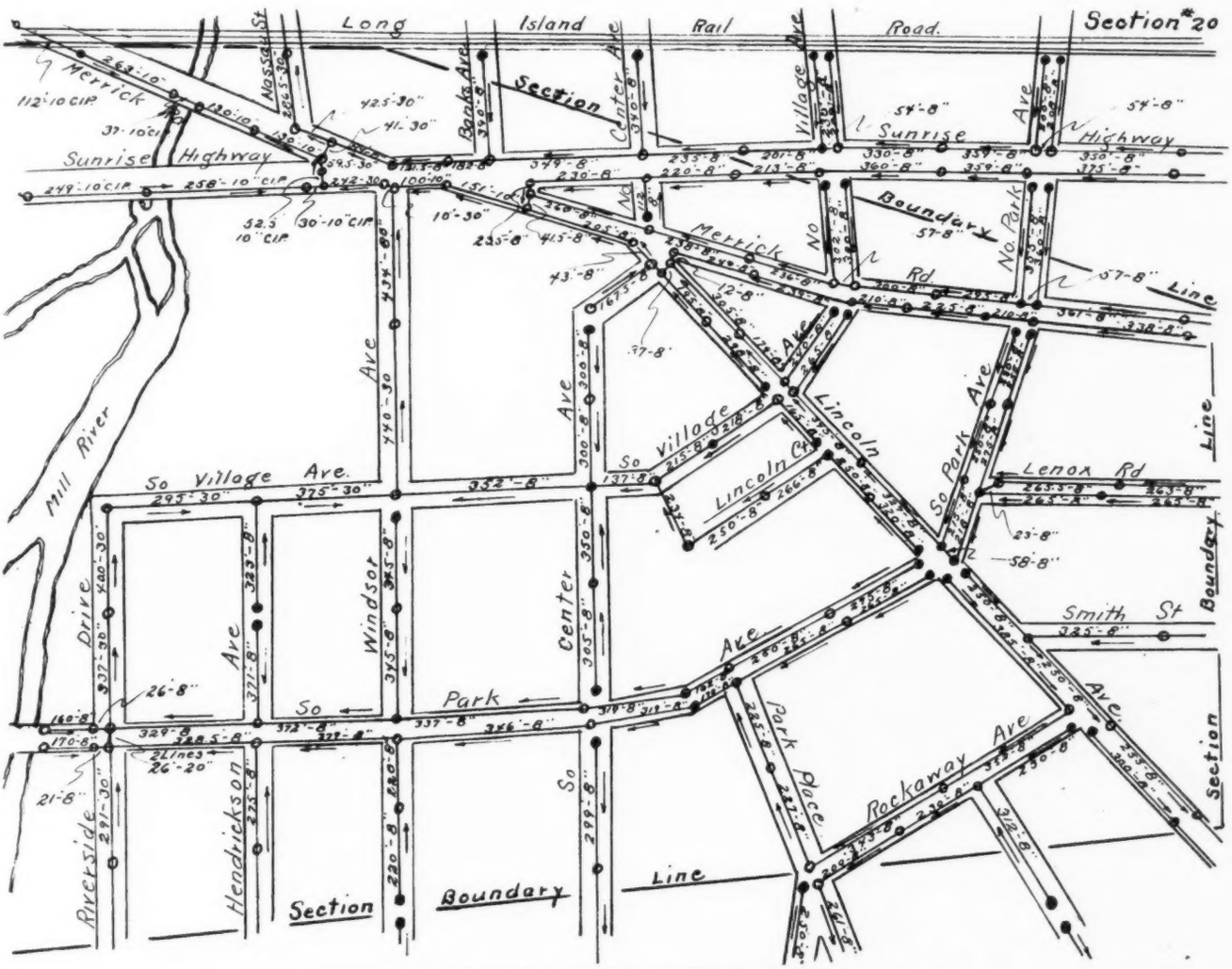
In the larger sewers (15 inch and above) we find that the large wire brushes, that are part of our "Turbine" line of equipment, can be used more efficiently for cleaning and indicating trouble than can the Flexible steel sewer rods.

The mere looking down at the flowing sewage, after flushing, does not indicate a clean free-flowing sewer. This much the experience related previously herein has taught us.

Flushing

The basic requirements for effective flushing of sewers are splendidly presented by J. D. Watson in WATER WORKS AND SEWERAGE for August, 1937, the same article being reprinted in the Reference and Data Section of the issue of April, 1939.

Sewers today are flushed both manually and automatically. The former method is done by using a hose or drawing from pond into the end manhole of a section of sewer line, known as a flush manhole. Also there is the automatic flush equipment frequently installed at the end of a line.



Detail Map—Section No. 20—Business District

Taken from our Section Map Book covering the 24 sections of the Rockville Center System—Practically indispensable in effective and economical maintenance work, recording, trouble finding, etc.

MAINTENANCE RECORD

RECORD OF ALL WORK DONE PERTAINING TO MAINTENANCE OF SEWERS

DATE	LOCATION OF WORK	SECTION	TYPE OF WORK DONE: FLEX. RODS	TURBINE CUTTER	FLUSHED	TOTAL FEET CLEANED	MISCELLANEOUS	REMARKS	NO. OF MEN	NO. OF HRS.	COST
4/4/39	So.Park Ave. bet.Lincoln Ave and Center Ave. S/S	20	X		X	489'		Found bad root condition	3	8	
4/5/39	S/S Lakeview west of Greenway St.	1	X		X	180'	On Complaint	Found break in line about 3' from 1st.			
4/11/39	S/S Park Ave bet.Center Ave and Riverside Drive	20	X		X	1053'		d.s.m.h.that filtered water & sand into sewer Bad root condition.	3	8	
4/11/39	N/S Park Ave.bet.Riverside Dr. and Center Ave.	20	X		X	1038'		Root condition - not bad	3	8	
4/12/39	N/S Park Ave.bet.Center Ave. and Lincoln Ave.	20	X		X	731'		Bad root condition	3	8	
4/12/39	E/S So.Village Ave.bet.Lincoln and Merrick Road	20	X		X	265'	On Complaint	Found roots in this line,no trees			
4/13/39	N/S Park Ave.bet Center Ave. and Lincoln	20	X		X	275'		within 150' of stoppage	3	8	
4/14/39	Center Ave.bet.Park Ave and Shellbank	20	X		X	869'		Bad root condition	3	8	
4/14/39	Windsor Ave.bet.Park Ave & flush manhole So. of Park	20	X		X	440'		Bad root condition - broke several rods	3	8	
4/17/39	Windsor Ave. So. from flush manhole to Shellbank Place	19	X		X	440'		Some roots - not bad enough to give trouble	3	8	
4/17/39	S/S Lakeview Ave West about 350' from Hempstead Ave	9	X		X	320'	Demonstration	Light roots	3	8	
4/18/39	Hendrickson Ave. from Park Ave so. to Shellbank Place	20	X		X	980'		New Sewer Cleaning tools used	3	8	
4/18/39	Hendrickson Ave from F.M.H. No. to So.Village Ave	20	X		X	323'		Bad root condition	3	8	
4/19/39	Hendrickson Ave from F.M.H. So. to Park Ave.	20	X		X	371'		Very bad root condition	3	8	
4/19/39	Windsor Ave. from So. Village to a point half way to Park	20	X		X	345'		Very heavy roots	3	8	
4/20/39	Windsor Ave from a point half way bet.Village,Park to Park	20	X		X	345'		Very heavy roots	3	8	
4/20/39	Center Ave. from Park Ave to Village Ave.	20	X		X	655'		Hoot condition - not bad	3	8	
4/21/39	Lincoln Ave. W/S from Lincoln Court to So. Village Ave	20	X		X	165'		Bad root condition	3	8	
4/21/39	So.Village Ave. from Lincoln Ave. down to Windsor	20	X		X	922'		Light roots	3	8	
4/24/39	W/S Lincoln Ave from So.Park to Lincoln Court	20	X		X	470'		Heavy root growth bet Lincoln Ave & Center Ave line partly clogged with sand	3	8	
4/24/39	Lincoln Ct. from Lincoln Ave to P.R.W. to So. Village Ave	20	X		X	750'		Light roots-line very sluggish	3	8	
4/25/39	Center Ave. from So.Village to Merrick Road	20	X		X	767'		Light roots-Lincoln Ct..Sewer opposite Lincoln Inn,filled with grease	3	8	
4/25/39	Lincoln Ave. W/S from Merrick Rd. to So.Village Ave.	20	X		X	558'		Light roots near Merrick Road	3	8	
								Heavy root growth near Petitts Bros.	3	8	

COST PER OPERATING DAY - PLANT SUPERVISION AND MOISTENING

Co.52 # LABOR AND MOISTENING

The equipment includes a siphon arrangement built into the manhole and discharging into the sewer. The flush tank is continuously refilled by a constant regulated flow of water into it, the rate being controlled by a special faucet. In operation, the flush tank is filled to a certain depth by the water from the faucet. When the head of water is sufficient to cause the siphon to start operation, the siphon empties the tank rapidly and thus flushes the sewer. The idea in all cases of flushing, be it drawn from a pond, by hose, or automatic flush tank, is to cause the flowing off of sewage solids depositing in a flat grade or "lazy" sewer. The hose flushing is the most practical and effective method, as it can be applied anywhere along the line.

The automatic flush, which is still being used, has to be maintained. The strainer and orifice through which the water flows to the tank has to be kept clear. Varying pressures in the water main has a tendency to loosen iron deposits which choke the strainer or orifice; also water that has been treated with lime and chlorine causes clogging and trouble with such equipment. There is also the cross connection hazard with this type of equipment which is now being eliminated as much as possible.

As mentioned before, a flow of water will not indicate a clean sewer. Unless properly applied water flow alone will not clean a sewer from a practical man's point of view, other than to flush through material that has been scraped and cut loose or those deposits that are rather easily moved. To clean a sewer effectively involves the removal of films that are building up to a thickness. To accomplish this, the positive scouring type of jetting nozzles must be run through the entire sewer. The flow from a fire plug may seem terrific on entering the line, but very soon levels out to nothing more than a fast flowing stream. As to how much it removes from the walls of the pipes is speculative.

Roots and Service Connections

Roots are the big problem in sewer maintenance. We know where they come from—but how to control them? We can to some extent cut down the trouble in the following:

1. Stricter inspection of new lines being laid.
2. Material used for joints. This is no better than workmanship of labor performing the job.
3. Ordinance directed to elimination of the most prolific root growing trees such as poplars, swamp maples, weeping willows, etc.

It has been interesting to hear some of the reports as to how roots will be attracted to sewage, passing up water directly under them and reaching out for a crevice or bad joint in a sewer line. There are many contributing factors—the temperature of sewage, and its content of plant food being the more important.

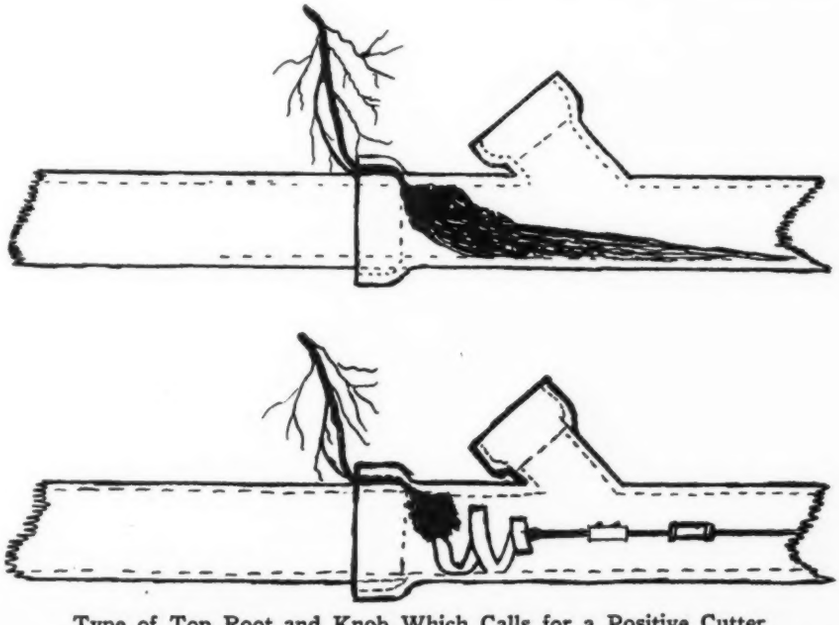
Service connections into sewers should be inspected as to grade and workmanship of a joint. A poor grade and joint means future trouble for all concerned,—user and Sewer Department. It is so easy to take drainlayer's and plumber's word for the work done, but once inspected and passed the installation becomes the responsibility of the department passing it. You may argue the point later and think that you have won out, but the taxpayer finally has his day, as we have witnessed so much of late.

The responsibility for maintenance of sewer connections results in a dispute many times. I contend and carry out the policy that where service charges are not made, a sewer lateral should be the sole headache of the one using it. The sewage and waste that is run out to the sewer comes from that property. Any trees in the vicinity are for his comfort, and for a department to take over responsibility from the curb to the main leaves us with the question, Where is the end? Most Sewer Departments have a limited personnel, and to be called out on each house stoppage occurring certainly makes a condition of despair many a time, because of the inability to catch up or demand more labor, which cannot always be justified. The use of castiron house connections will eliminate much grief for all concerned.

The policy as to sewer connections lays with a governing body of a community, and it is the duty of an officer of a department to bring forcibly, and with clarity, any constructive measures that he recommends. If this is done, he has done his duty to himself and the taxpayer. It is his duty then to carry on to the best of his ability.

Pump Stations

The pump station is the central point to which all gravity lines feed, and it puts us in mind of a large city into which everything pours and straggles, and with positive energy must clear itself to survive. And so in our pump stations, consideration must be given to what comes in and to what extent we must go to dispose of it. The very mention of a pump station brings to us the fact that there is equipment to be considered. Screens, be they bars or baskets or mechanical grinders, have to be kept clean and the mechanism has to be checked regularly for lubrication, wear and tear. Pump and motors should be inspected regularly as to alignment, lubrication—changing old oil and grease at least once a year. Check pumps for clogging, also condition of packing. Pumps should be taken down at least once every five years, if they have run that long without trouble. In that way parts may be replaced at your pleasure and

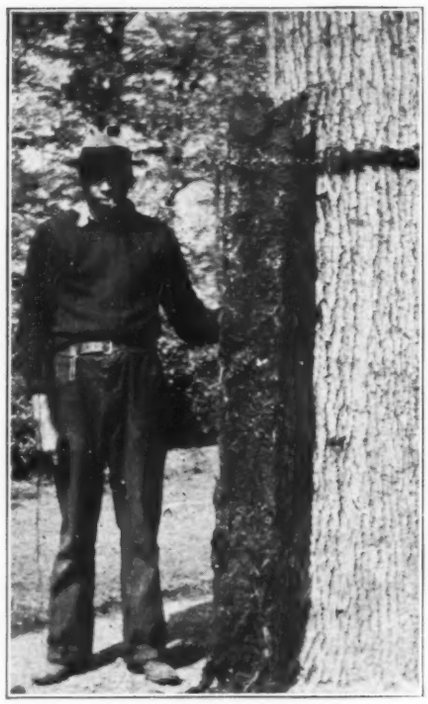


Type of Top Root and Knob Which Calls for a Positive Cutter
(*Here the Water Pressure Driven Turbine Cutter does the Job.—See Text.*)

not at some inconvenient time, as an emergency. The conditions under which a pump works more or less determines the time for inspections.

Chlorinating equipment should be inspected for leaking joints; exposed parts should be covered with vaseline; strainers and other parts that clog with salts should be inspected as often as necessary. Under ordinary conditions once every three months is sufficient. Chlorine causes considerable trouble to electrical equipment and the two should never meet. Newly designed stations have a complete separation of the chlorine room from other parts of the building.

The well into which all the sewage flows should be kept clean for at this point sludge and grit settle out and putrifaction and odors set up which become a nuisance to surrounding properties. Daily flushing of a well is the most efficient way of keeping it clean. Any solids or grit which have settled can easily be flushed away with an inch and a half hose and nozzle. While considering the adjacent property owners, it is well to consider the beautification of the grounds and maintenance of the inside and outside of the building. The care of pump stations, if there are enough of them, warrants a utility man whose job it is to keep them in condition.



One of Our Pets

A prize root which tore away, leaving a five-finger knob on the top inside of pipe —see sketch—which was still a stoppage producer.

Costs

The cost of this type of maintenance shows an excellent economy in the form of a satisfied public, and also in dollars and cents. The equipment needed for effective maintenance totals some $2,700, and we plan on replacement every three years. Depreciation and interest runs the equipment cost to about $900 per year for our system. To this must be added $25 per day for 150 days per year to cover planning, administration, supervision, labor—say $3,750 per year.

Based on a coverage of 26 miles (137,280 feet) the cost per foot of sewers cleaned and maintained is—

$$\frac{(150 \text{ days} \times \$25) + \$900}{137.280 \text{ ft.}} = \$0.34 \text{ per foot.}$$

To cover liability, other insurance, and miscellaneous items such as gasoline, water used, etc. The cost may run to 4 cents per foot maximum.

Summing Up

The old method of sewer maintenance, which usually amounted to keeping the fingers crossed until the next call for help is made—then digging up the streets, making repairs, refilling and repaving, resulting in disgruntled taxpayers—is very expensive as against an orderly economic sewer maintenance program. At least such has been our experience in Rockville Center.

WILLARD JACOBS HONORED

Came to Chemical Industry from Water Works Field

S. W. Jacobs

S. Willard Jacobs, Vice-President in Charge of Sales, for the Electro Bleaching Gas Company and Niagara Alkali Company was honored on December 6th, at a testimonial dinner tendered him by the President and other officers of The Chemists' Club, in New York City.

This dinner was given Mr. Jacobs in appreciation of his valued and long time services to the Club as Trustee for 11 years and as Chairman of the House Committee for six years. The latter job he was turning over to another "wheel-horse"—Bob Quinn of Mathieson Alkali Works, Inc.

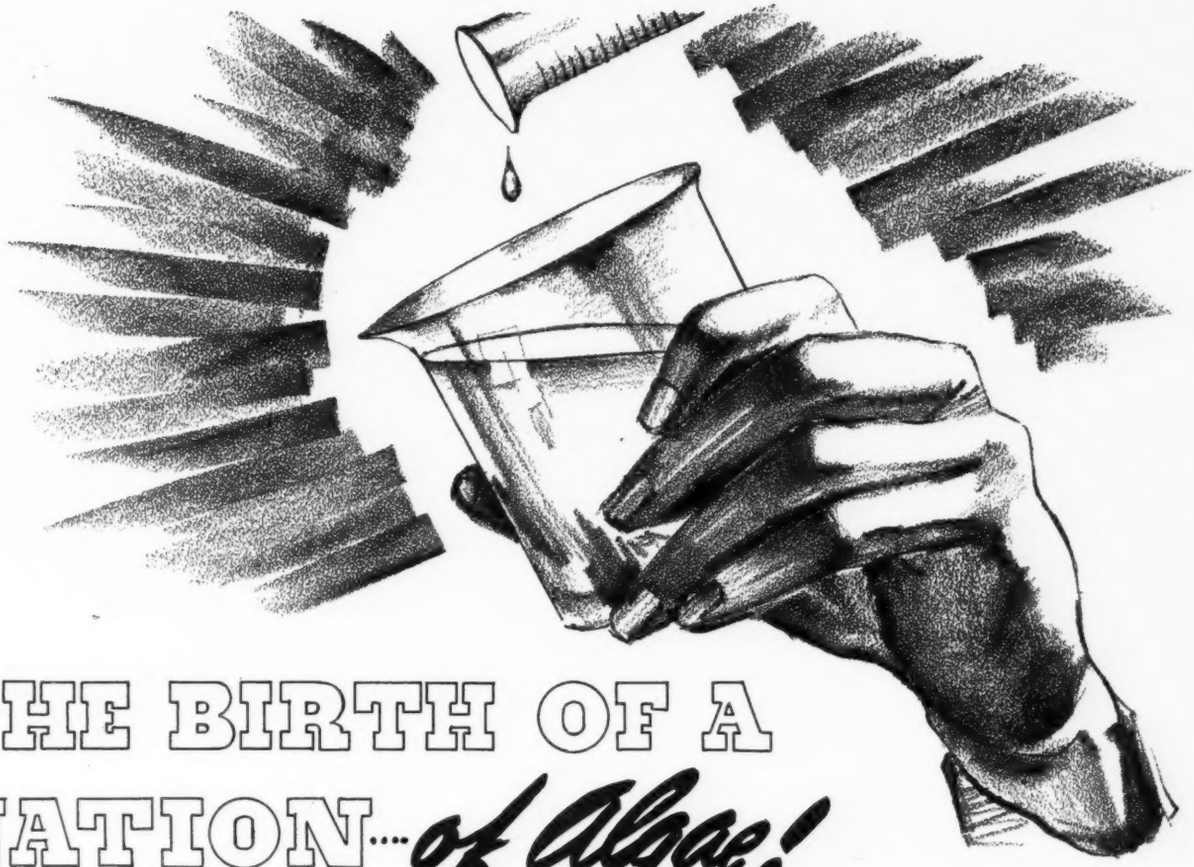
W. & T.'s "Bill" Orchard, who has long and intimately known Mr. Jacobs, acted as Master of Ceremonies and had many fine things to say about his friend "Jake"—as he is best known to his many friends. And there were fine things said of his enviable qualities by the club officers and others. At the close of the dinner he was presented with a handsome piece of "that material of which he is"—Sterling.

Willard Jacobs held the position of Chemist and Assistant Superintendent at the St. Louis Filter Plant when in 1917 John Kienle, then with "E.B.G." Co. (also a former water works chemist) persuaded "Jake" to come to New York and help him sell the new E.B.G. chlorinator—the original solution feed chlorinator developed and patented by Dr. Geo. Ornstein, then employed by "E.B.G." Co. But, "Jake" soon afterwards figured he could do a better job for his company by selling chlorine. And, so the E.B.G. chlorinator and Ornstein's patents were transferred over to Fred Wallace and Mike Tiernan —then struggling to manufacture as many machines as "Bill" Orchard, the young "go-get-'em" Sales Manager, with 5 telephones at his elbow (we suspect 3 for benefit of visitors) was selling.

This decision started "Jake" on his road to success—that, plus the fact that Jack Kienle went over to Mathieson Alkali to become a competitor. And, so he sold much chlorine and caustic soda, which netted him the earned promotion in 1926 to the position of Vice-President—first in Charge of Sales, and now pretty much in charge of everything.

"Jake's" success has been contingent on his high regard for truth and fair play, which has earned him a high degree of trust from all who know him. This is what everybody said of him at the testimonial dinner. Indicative of as much, Mr. Jacobs was chosen by his competitors to head The Chlorine Institute, Inc.,—the successful trade association of which he has been President for the past six years.

We could wish no satisfaction greater than the opportunity to "echo" the many splendid things that were said of this ex-water works operator and respected citizen—Willard Jacobs.



THE BIRTH OF A NATION....*of Algae!*

It has been said that a single plant of algae can have 1,000,000 children and grandchildren in one month. But however interesting and picturesque algae are, they are ever a source of annoyance to practical-minded waterworks superintendents.

Tastes and odors due to algae can be so intense and obnoxious at times that they can be considered in epidemic proportions, and the consumer complaints do become sufficiently frequent and severe to be very disheartening and discomforting to water plant operators. The water plant operator knows that the water being delivered to the consumer is safe from the bacteriological standpoint, yet this means little to the average layman when asked to drink unpalatable water. The result is a rush to springs, wells, etc., where more palatable, but possibly less safe, water is obtainable.

The result may mean an epidemic of water-borne diseases which may have been avoided if proper means were taken to overcome the tastes and odors and thus prevent Mr. John Public from going to unauthorized sources for water.

American Water Works Association 60th Annual Convention April 21-25, 1940 Kansas City, Mo.

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

NEW YORK CITY	CHICAGO	PHILADELPHIA	CLEVELAND
230 Park Avenue	35 E. Wacker Drive	1322 Widener Bldg.	417 Schofield Bldg.

NUCHAR — ➡ AQUA NUCHAR

W. V. WEIR—

LOW MAINTENANCE

is an economy feature of cast iron pipe that is far from exceptional. An impartial survey among 195 waterworks superintendents shows that the maintenance cost of cast iron pipe is far below that of any other pipe material which has been in use long enough for the recording of conclusive data.

LONG LIFE

In the municipally-owned water supply system of the City of St. Louis this cast iron water main, now in its 110th year of continuous service, is saving tax-dollars for the citizens. Another material would have doubtless been replaced long ago.

SALVAGE VALUE This is the 12-inch cast iron pipe, referred to in Mr. Weir's statement above, which was salvaged after 19 years' service and relaid in a new location. The St. Louis County Water Company used 24-inch cast iron pipe to replace the original line.

Water mains represent about one-third of this country's 5-billion-dollar investment in public water supply systems. More than 98% of these mains are cast iron pipe with a *known* useful life at least double the *estimated* life of other water main materials. Because the tax-saving, through deferred replacements alone, is enormous, cast iron pipe is known as Public Tax Saver No. 1.

Look for the "Q-Check" Registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.

B. W. CULLEN

Superintendent, Water Pipe Extension, Chicago Water Department:

"Under the head of maintenance expense, the Chicago Water Department includes the cost of repairing mains, services, hydrants, valves, meters and, in general, all appurtenances that have to do with the distribution of water. The actual cost of maintaining the MAINS ONLY is very small, even though some of these cast iron mains, of which we have in all 3776 miles, are as much as fifty years old. In thirteen miles of 24" to 48" mains for which definite records were examined, some laid as far back as 1881, the actual cost per mile, per year, on the average was $5.93."

J. E. GIBSON

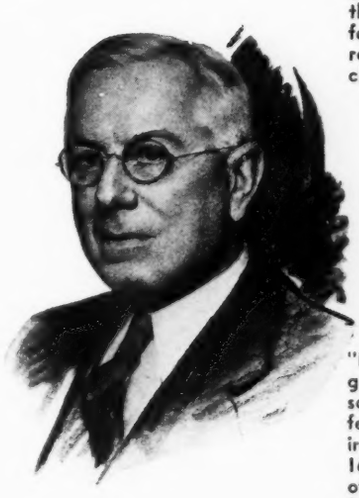
Manager, Water Department, Charleston, S. C., former President of A.W.W.A.:

"The cost of maintenance for the last five years on an original 24" line of cast iron pipe, 51,700 feet laid in 1903, is 28.01, or roughly 60c PER MILE PER YEAR. During the entire 36 years there has been only one break. All other repairs have been due to leaking joints caused by vibration or settlement. We think this is a splendid record."

E. F. DUGGER

General Manager, Newport News, Virginia, Waterworks Commission and Former President of A.W.W.A.:

"We have an 18" cast iron supply line 16 miles in length, approximately 50 years of age, on which the total repairs for the year 1938, covering labor and material, amounted to slightly less than $40 ($2.50 per mile). This cost for 1938 is a comparable figure for repairs since 1926 at which time I took charge of the system."

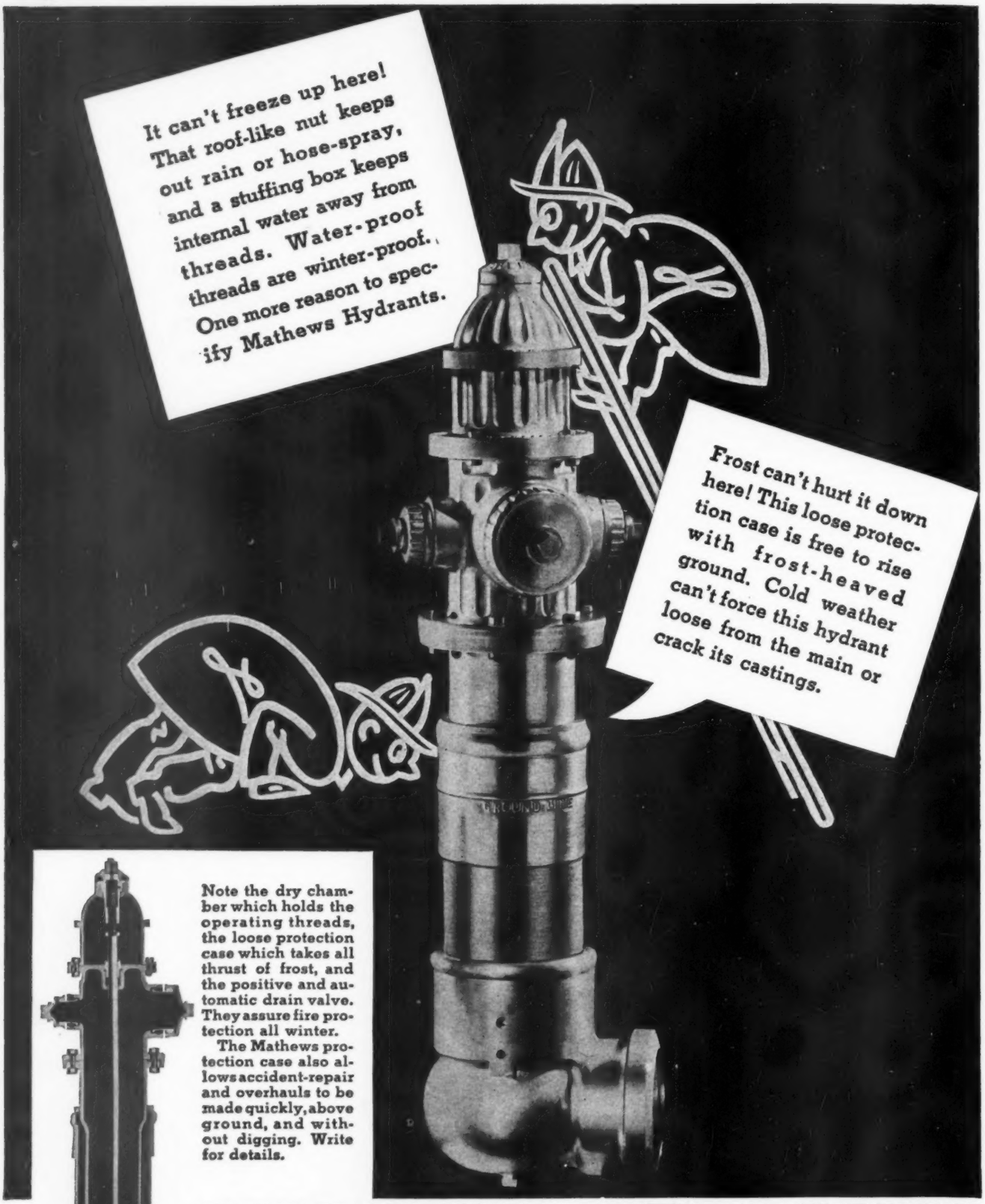


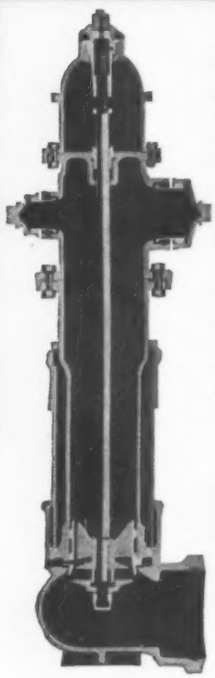
W. W. HURLBUT

Engineer of Water Works, Los Angeles, Cal., and Former President of A.W.W.A.:

"In the high value district of Los Angeles, comprising approximately one square mile, there are 147,000 lineal feet (approximately 26 miles) of cast iron pipe in diameters 24", 20", 18", 16", 12", 10", 8", and 6". The oldest of this pipe, the 18", was laid forty-five years ago. The system is operated under seventy-five pounds pressure.

"The maintenance and repair costs for these twenty-six miles of distribution lines for the past ten years amounted to $143.00. Repairs were due to four breaks. This results in the low cost of 55c per mile per year."


It can't freeze up here! That roof-like nut keeps out rain or hose-spray, and a stuffing box keeps internal water away from threads. Water-proof threads are winter-proof. One more reason to specify Mathews Hydrants.
Frost can't hurt it down here! This loose protection case is free to rise with frost-heaved ground. Cold weather can't force this hydrant loose from the main or crack its castings.



Note the dry chamber which holds the operating threads, the loose protection case which takes all thrust of frost, and the positive and automatic drain valve. They assure fire protection all winter.

The Mathews protection case also allows accident-repair and overhauls to be made quickly, above ground, and without digging. Write for details.

MATHEWS HYDRANTS

Made by R. D. WOOD COMPANY

Manufacturers of Sand Spun Pipe (centrifugally cast in sand molds) and R. D. Wood heavy-duty gate valves for water works

400 CHESTNUT STREET, PHILADELPHIA, PA.

SEWAGE ANALYSES

The Significance and Interpretation of Results*

By DR. RICHARD POMEROY
Research Chemist
LOS ANGELES COUNTY SANITATION DISTRICTS
LOS ANGELES, CALIF.

MANY operating problems have been solved by laboratory tests, and those plants which have some laboratory control are usually better operated than similar plants where laboratory tests are not made. Increasing complexity of sewage treatment processes will cause the laboratory tests to be of added importance in the years ahead, and improvement of analytical methods will justify more confidence in the results of such tests.

Criticism of laboratory tests from the standpoint of the operator is chiefly due to four faults. The discussion which follows is designed to enable operators to avoid some of these faults, and to appreciate the proper significance of laboratory tests:

1. Erroneous results due to improper sampling.
2. Erroneous results due to improper test technique.
3. Unwise selection of tests.
4. Needless routine repetition of tests of little value.

The Sampling Problem

In order to avoid erroneous results, it is of course necessary that the operator learn how to carry out the laboratory procedures. The most important cause of error, however, is not in the laboratory procedure, but is in faulty sampling. Much time may be wasted in making careful laboratory analyses on samples which fail to correspond to the materials which they are supposed to represent.

Crude Sewage

Proper sampling of sewage influent to a treatment plant is difficult. Sewage varies in quality as well as quantity from hour to hour, and a single grab sample of raw sewage cannot be expected to give much information as to the average strength of the sewage throughout the day. Representative samples can be obtained only by compositing subsamples taken at least hourly. The sub-samples must be composited in proportion to the flow. In plants where no one is in attendance at night, a few special samples should be taken of the sewage during the night, and from the test results a correction worked out which can be applied to the results obtained on daytime composites, to give approximate 24-hour averages.

Sampling of raw sewage is further complicated by the coarseness of part of the suspended matter, and by the lack of uniformity of the sewage in various parts of a flow channel. This is of no importance for tests depending upon soluble matter, such as the alkalinity test, pH, etc., but for determinations of suspended solids, settleable solids, turbidity, and B.O.D., care must be exercised to secure a representative proportion of solids.

When sewage is flowing at moderate velocity through a sewer or other channel, the heavier solids are rolled along and concentrated near the bottom. Samples from such channels will at best be only approximations of true samples. If the sewage passes through pumps or channels where there is agitation, satisfactory samples may be more likely secured at such places.

Effluents

The sampling of treatment plant effluents is less difficult than the sampling of raw sewage. Coarse material has been removed and in the case of effluents of trickling filter and activated sludge plants, hour to hour variations are smaller than with the raw sewage. Sub-samples for composites may be taken at 2-hour intervals instead of hourly. Bear in mind that the daytime samples may give an entirely false picture of the average condition of the effluent. Much of the effluent which leaves the plant during the early part of the day may have been weak night sewage, and may have undergone prolonged treatment, so that it will be much lower in B.O.D. than the effluent leaving the plant during the evening hours. A few tests on samples taken around the clock will give a satisfactory indication of the strength of the effluent where routine sampling is possible only during part of the day.

All sewage and effluent samples should be preserved by icing in order to protect against bacterial changes in the sample bottle.

Sludges

The sampling of primary sludge for measurement of the solids (or moisture) content is very difficult. Sub-samples must be drawn almost minute by minute when sludge is being pumped if a representative composite is to be secured. This is rarely practical. Solids determinations on raw sludges, when made on grab samples, are seldom representative. Determinations of the percentage of organic matter in the sludge solids (or per cent volatile) in contrast to the solids determinations, are generally satisfactory if any reasonable care is used in sampling.

Activated and digested sludges are usually more uniform than primary sludge, and significant samples for moisture content may be secured with ordinary care.

No set of rules can be laid down for sampling at a sewage treatment plant. Each situation will have its own peculiarities and its own requirements. The operator must be aware of the importance and the difficulties of securing representative

* This paper served as the basis of a lecture before the Water and Sewage Plant Operators Short Courses of the 11th Annual Institute of Government, held by the University of Southern California under joint sponsorship of the California Sewage Works Ass'n. and the California Section of A.W.W.A.—Ed.

samples. It is far better to take a few reliable samples than to spend much time analyzing samples which are not representative.

To avoid the faults of poorly-chosen tests, and of wasted time on routine tests which are of slight value, the operator must know the purposes and significance of the various tests which he may choose for his own testing routine. Such knowledge will also enable him intelligently to read and discuss the results reported from other plants.

Every plant should have a schedule of routine tests, and a repertoire of tests for use in special investigations. This schedule may include nothing more than visual observations, or it may require the services of a full-time chemist. It should include only tests which have a definite purpose. The purpose may be to gain information useful in operation of the plant; it may be to ascertain if the quality of the effluent is of suitable purity for utimate disposal; it may be to assist in future design; or it may be to demonstrate to the city, district, or state authorities the accomplishments of the plant. But it never should be to fill blank spaces on sheets which will never again be used. The schedule should be flexible. If a test has been made routinely for some time, and is ceasing to show enough new information to be of definite value, then it should be taken less often, or dropped altogether, or replaced by another test.

Following are the tests which may serve useful purposes in sewage treatment plants:

Physical Tests

Appearance and Odor: These are not laboratory tests at all, but they may be made so easily and often tell so much that they should always be present in the operator's report. If the sewage presents no unusual appearance, then the operator should make the practice of recording the word "normal," or some equivalent. If he does this he will not forget to record the unusual conditions when they appear. The appearance frequently gives clues to industrial wastes, and may also indicate the condition of the sewage as regards septicity. "Odors" should include mention of hydrogen sulfide and any other odors likely to cause complaints. Also, odors of gasoline or dry-cleaning solvents should be particularly observed, as vapors of these materials in the sewers constitute a serious explosion hazard and should be eliminated.

Temperature: The operator should know the temperature of his sewage, even though he can't do anything about it. The information may be of value to the engineer or consultant. Routine temperature tests are not necessary; occasional tests taken regularly during the various seasons are sufficient.

pH, Alkalinity, Chlorides

Determination of the pH values of sewage entering a treatment plant is properly recommended as a routine test in most situations. It provides information which may be useful in explaining variations in plant behaviour, and is valuable in detecting industrial wastes. If the pH at any place in a sewerage system drops below 5, it is an indication that the sewage is being loaded with acid wastes to a point which threatens the process and the concrete. The pH test is not of outstanding importance, but the slight effort required to make the test is usually well repaid.

Alkalinity titrations may also be useful in locating industrial wastes and it provides a quantitative measure of the capacity of the sewage to receive acid wastes. Occasional alkalinity measurements are of value in many places, but the test is rarely of sufficient importance to be made a matter of routine. In plants producing a well-oxidized effluent there is a substantial decrease in the alkalinity of the sewage in the treatment process. This is due in part to the reduction of the ammonia concentration and the formation of nitrite and nitrate. The decrease of alkalinity is sometimes used as an indication of the efficiency of the treatment, but it is not well-suited for this purpose.

Chloride determinations are sometimes of value in special situations, as for example in measurements of salt water infiltration and in tracing industrial wastes. The chloride content of sewage is higher than of the corresponding water supplies.

Measures of Sewage "Condition"

Sulfides. The measurement of sulfides in sewage is in many places a matter of great importance. In the majority of cities of California sulfides in the sewage are either a threat or a serious problem. In such places regular tests should be made for sulfides in the sewage reaching the treatment plant. Even a half part per million of dissolved sulfides will cause odor nuisances, tarnishing of brass and paints, and slow disintegration of concrete in confined conditions. A record of sulfide tests will indicate whether the situation requires remedial measures. If some control measures must be taken, they may include: cleaning of the sewers, ventilation of the sewers, control of industrial wastes, treatment of the sewage with metallic salts, or chlorination. Whatever control measures may be used, it is evident that regular sulfide tests are required as a measure of the adequacy of the control.

A distinction must be made in sulfide tests between total sulfides, dissolved sulfides, and hydrogen sulfide. Dissolved sulfides may be distinguished from the sulfides held in the suspended matter by removing the suspended matter with coagulants and analyzing the clear liquor. In ordinary sewage the concentration of total sulfides may be of the order of 0.5 p.p.m. before any appreciable concentration of dissolved sulfides will be present, but in sewage which has been treated with metallic salts for sulfide control the insoluble sulfides may have almost any value, since the purpose of the metallic salts is to convert dissolved sulfides to insoluble metal sulfides. Hydrogen sulfide, which is the direct cause of the trouble, is determined by calculation from the dissolved sulfides and the pH. [This method, developed by the author, is fully described on page 279 of the August 1936 issue of WATER WORKS & SEWERAGE.—ED.]

The detection of hydrogen sulfide in the atmosphere by the use of lead acetate paper is extremely simple and may be a valuable test. The paper darkens in the presence of traces of H_2S. The operator can estimate the seriousness of the condition by the rapidity of blackening. [For a simple method see "The Determination of Hydrogen Sulphide"—by George Martin, page 501, December 1939 WATER WORKS & SEWERAGE.]

Measures of sewage condition are concerned not only with septicity, as indicated by sulfides, but also with oxidized conditions attained by biological oxidation and by chlorination. Special tests for biologically oxidized effluents are discussed later under "Special Tests for Oxidation Plants."

Chlorine Residual. Determinations of chlorine residual are essential where chlorination is practiced. Ortho-tolidin is almost universally

used for this purpose. All of the chlorine added to sewage in any ordinary case enters into combinations. Some of these combinations remove the chlorine completely from the field of action. Others hold the chlorine loosely, so that it may be released to react with other substances. The ortho-tolidin tests measure a part of this loosely-held chlorine. Less chlorine than is required to show a so-called residual may suffice to accomplish a high degree of sterilization, especially if the object is sulfide control, yet many microbes are not killed until the chlorine dosage is much higher than is required to show a residual. In the chlorination of crude and settled sewage the test must be looked upon as more qualitative than quantitative. The operator may distinguish between a "strong residual" and a "weak residual," but numerical values in parts per million are generally of no significance. In the case of well-clarified sewage effluent the results may have quantitative value. With these limitations properly emphasized, we must still recognize the test to be very important for chlorination control. Bacterial tests, later discussed, likewise serve to measure efficiency of chlorination.

Chlorine demand tests are also useful in chlorination control. They show the amount of chlorine required to reach some arbitrary point, such as the starch-iodide end-point or the orthotolidin end-point. The test not only serves to determine chlorine requirements, but also may provide information as to the septicity of the sewage and may aid in evaluating the effect of industrial wastes.

Measures of Sewage "Concentration" and Plant Efficiency

Various tests have been devised to indicate the amount of pollution, or the "strength" or "concentration" of sewage or effluent. Since these tests may be used for comparisons of raw sewage and effluent, they may serve as measures of accomplishments of the plant.

Settleable Solids. A simple and reliable test of efficiency for plain sedimentation installations is the settleable solids determination using Imhoff cones. If used as a matter of routine, this must be made on composited samples.

Turbidity. The turbidity test is especially useful in determining the relative degree of clarification of effluents, and may be made to give a good approximation of the suspended solids content.

Suspended Solids. A still more accurate test is the suspended solids determination, made by filtering through an asbestos or paper filter and weighing the solids collected. What has been said previously about the difficulties of sampling raw sewage must be recalled here; this difficulty frequently gives misleading results. Another source of error in this test arises from the fact that 5% to 10% of the suspended solids of sewage are so coarse that they must be rejected when a small sample is taken for filtering. Hence the result of the analysis is bound to be low even if the original sample is as representative as one can possibly hope for. Because of these errors suspended solids determinations cannot be used for more than approximate calculations of the weight of sludge expected to be removed by sedimentation.

Volatile Solids. The proportions of organic or "volatile" matter in the suspended solids is sometimes determined by igniting the filter and reweighing. This determination is too inaccurate and of too little interest in the case of ordinary sewage to be recommended for routine work.

Dissolved Solids. Dissolved solids determinations are of some interest in biological oxidation processes, because these processes remove some dissolved and colloidal matter. Total solids or dissolved solids determinations are necessary, if one wants information as to the solids removal in these processes. Because of the inherent inaccuracies of the test, one should not attach any significance to the day-to-day variations in the apparent dissolved solids removals; only averages of a week or a month are significant.

B. O. D. The most widely-used measure of the degree of purification is the B. O. D. test. This test is of great value, but does not have the absolute significance sometimes attributed to it. The results may vary according to the dilution employed, the oxygen concentration, the type of microbes present, the nature of the diluting water, and even the brand of distilled water used for making synthetic diluting water, since certain commercial distilled waters contain significant impurities. It is desirable to set at least two dilutions on each sample. If the test is made with care, the results are valuable in revealing day-to-day variations in the efficiency of a plant, and in comparing similar plants. It should not be used as a sole criterion for comparing plants of different types, nor should it be used uncritically for testing industrial wastes.

Oxygen Consumed. The "oxygen consumed" test has been widely used in the past, and is still used in many places, especially in England. It is used to measure concentration and has the advantage of yielding results quickly.

Organic Carbon. The determination of organic carbon has also been proposed as a measure of sewage strength. This test has not yet come into extensive use, although results are obtained in a few hours.

Ammonia and *Organic Nitrogen* may also be used to measure the relative concentrations of various sewages.

Special Tests for Oxidation Plants

Relative Stability. This test is in part a measure of the pollution remaining in an effluent, and in part, a measure of the "condition" relative to the supply of oxygen. It is valuable as a comparative test if properly made, but the slightest air bubble in the bottle at any time during the incubation period invalidates the test. This source of error is common.

Dissolved Oxygen. In dissolved oxygen determinations, special care is required in sampling. Samples should be dipped from the final clarifier or secondary sedimentation tank, rather than from a flume or pipe after the effluent has tumbled over a weir, and they must be analyzed promptly after they are taken. The D.O. content of the effluent gives valuable information to aid the operator in control of the plant. In activated sludge process, throughout the plant it is the most valuable of all control tests, except possibly the determination of sludge percentages by settling in graduated cylinders. The activated sludge process cannot function satisfactorily when the tanks become devoid of oxygen. An oxygen content in the final clarifier of 1×2 p.p.m. is sufficient. If the oxygen content in the final clarifier rises above 4 p.p.m. the operator may cut down the air supply and thus conserve power. If the D.O. becomes too low, obviously the air supply should be increased. If the air supply cannot be increased, a deficiency of oxygen may be remedied by cutting down the circulating load of activated sludge. It is better to have a low concentration of properly aerated sludge than to have a lot of semi-septic sludge. It often becomes desirable to measure the oxygen

concentration at various points in the aeration tanks. When D.O. tests are made directly upon the mixed liquor of the aeration tanks, the result is only approximate, since the sludge consumes some oxygen after the chemicals are added. Such results are nevertheless valuable for control purposes.

Nitrites and Nitrates. Well-oxidized effluents, whether from activated sludge or trickling filters, contain nitrites and nitrates, and the concentration of these constituents is an indication of the adequacy of the treatment.

Sludge Concentration. Discussion of special tests for oxidation plants would not be complete without mention of the sludge concentration test, so important for control purposes in activated sludge plants. This test is made by settling the mixed liquor in one liter cylinders. The operator must bear in mind that this test does not show the true solids concentration, since there is great variation in the settling properties of different activated sludges. The actual sludge concentration can be determined only by measurements of suspended solids. In activated sludge plants, dissolved oxygen determinations should always be used in conjunction with the sludge concentration tests.

Sludge Analyses

Solids Content (or Moisture Content). Sludge samples to be analyzed for solids content must be taken with great care, as mentioned previously. In the case of raw sludges, this test provides a basis for judging whether the sludge is being removed with a solids content as high as may be hoped for, and to determine the influence of variations in operation upon the concentration of the sludge. In the case of primary sludge, an average solids content of 4% is generally adequate, although concentrations as high as 6% or 8% may be obtained. Activated sludge with 2% solids is considered satisfactory. Long detention of digested sludge will allow concentration to 10%, but if the sludge is to be dried on sand beds or fields, there is small advantage in concentrating it to more than 5% solids.

Per Cent Organic (or Per Cent Volatile). The principal use of the organic percentage determination on the sludges is for calculating the per cent destruction of the organic matter in the digestion process. The mineral matter in the sludge is practically unchanged in digestion, and hence the ratio of the organic matter to this mineral (ash fraction of the sludge) provides information on how much of the organic matter is converted to gas. Let us suppose that the raw sludge has 3 parts of organic matter to 1 part of ash (75% organic), and that after digestion it has 1½ parts of organic to 1 part of ash (60% organic); since 3 parts of organic have been reduced to 1½ parts, this represents 50% destruction of the organic matter, which may be considered to be satisfactory digestion. It must be borne in mind that the actual percentage organic in the digested sludge is not a measure of the digestion, since this fluctuates widely with variations in the composition of the new sludge. Rather, it is the percent reduction of organic matter that is significant. In view of the large fluctuations which the composition of raw sludge is likely to show, it is evident that only long-time averages can be used for reliable calculations of the per cent digestion.

A further use of the determination of organic percentage of digested sludge is in judging its fertilizer value, since the fertilizer value is roughly proportional to the organic content. The nitrogen content of the dry sludge is approximately 6% of the organic percentage. Thus, a sludge with 50% of organic matter may be expected to have about 3% of nitrogen.

pH. Determinations of the pH of digesting sludge are of use if the sludge is being treated with lime to start digestion. They may also be of value in diagnosing trouble when the sludge is foul smelling and appears to be digesting poorly. The test does not have any value for routine purposes in digestion tanks which are functioning normally, and its widespread use to judge the completeness of digestion is *not* warranted. Completeness of digestion is only one of several factors which may influence the pH, and even when other variables do not enter in, the pH is not sensitive enough to the progress of normal digestion to be of value. The true pH of the liquor of digesting sludge is rarely above 7.4 and probably never above 7.6, yet values of 7.8, 8.0, and even higher are often reported.

Volatile Acids. If one wishes analytical measures of the completeness of digestion which are more sensitive to short-time variations than is the per cent reduction of organic matter, then use may be made of the determination of volatile organic acids, of ammonia in the sludge liquor, of bicarbonate concentration, or of alkalinity of the liquor. Determination of the volatile acids is of the greatest value. In the early stages of digestion the acid concentration reaches high figures. Subsequently these acids are destroyed. When their concentration drops below 200 p.p.m. the sludge can be dried without odor nuisance or the breeding of flies regardless of the extent of digestion of other organic matter.

Ammonia concentration measures the extent of digestion of the proteins of the sludge.

The *Bicarbonate* concentration of the sludge liquor is determined principally by the difference between the organic acids on the one hand and ammonia on the other. The bicarbonate in turn is the essential factor controlling the pH. The relative accuracy with which the bicarbonate concentration can be determined is a hundred times as great as the corresponding accuracy of the pH test, and the test is quite simple.

The *Alkalinity* titration of the sludge liquor is even simpler than the bicarbonate test, and gives almost the same result as the bicarbonate test, if the sludge is reasonably advanced in digestion.

In view of these facts, it is desirable for operators of small plants to make pH tests of the digesting sludge only when it is of foul odor and digesting poorly, and under other conditions to make occasional determinations of bicarbonate or alkalinity. In large plants it is desirable that occasional or routine tests be made for volatile acids, ammonia, and bicarbonate, and when this data is available the pH test of sludge can be abandoned entirely.

A frequent question is, "What is the relation of pH to foaming?" The answer is that, with one exception, there is no correlation known between pH and foaming. The exception is, when the acid content of the sludge is very high and the pH consequently low (below 6.8), and gas production is low, a subsequent acceleration of digestion will generally be accompanied by foaming. This is the condition usually experienced when a tank is placed in service without seed sludge. Foaming which occurs under other conditions apparently is not related to the pH, or to any other simple measure of the condition of the sludge liquor.

Bacterial Tests

Bacterial counts on raw sewage are enormous, and are very high on all effluents except those which are

well clarified and then chlorinated. The bacterial tests are ordinarily made only on such effluents, or along streams or bodies of water into which effluents are discharged. The two commonest tests in this class are the so-called total count or agar plates, and the coli-aerogenes test. The first of these tests gives the total number of bacteria which are able to grow into colonies in plates of nutrient agar. The result does not represent the total number of bacteria in the sample, for the nutrient agar will support the growth of only a minor fraction of the innumerable species of bacteria which may be present. Furthermore, the agar plates give no information as to the presence of micro-organisms of the important class known as protozoa—the animals of the microsope world. The test gives results, however, which are important for comparative purposes.

The coli-aerogenes test indicates the presence of bacteria of a certain group. These bacteria are found in enormous numbers in feces, and their presence in water indicates the probable presence of fecal contamination. Water showing these bacteria is considered unsafe—not because these bacteria are harmful but because their presence indicates that the water may also contain microbes of intestinal diseases, such as the typhoid bacteria and the dysentery amoeba. When a well-clarified effluent is chlorinated, the total bacteria counts may be reduced to relatively small numbers, and bacteria of the coli-aerogenes group may be virtually completely eliminated. Along with the coli-aerogenes group will go practically all of the pathogenic microbes, with one exception—the protozoa known as entamoeba histolytica — cause of amoebic dysentery. Chlorine does not kill these amoeba. Examination of the water with the microscope is required to detect the presence of the amoeba.

W. C. HAWLEY
1865-1939

W. C. Hawley
(As he appeared at his last Water Works Convention in Montreal, Que. Sept. 1939.)

William Chauncey Hawley, engineer, executive, gentleman, died at the age of 74 at his home in Wilkinsburg, Penna., on Dec. 10th, 1939. He is survived by his widow, a daughter, a son and four grandchildren.

For the last 37 years of his life W. C. Hawley was Superintendent and Chief Engineer of the Pennsylvania Water Company, and for the success and standing of his company in the communities served he was largely responsible.

Mr. Hawley was born in Cambridge, N. Y., August 31st, 1865. Therefore, by the calendar he was 74 years old, but both mentally and physically he appeared a much younger man. As one who knew him well—John H. Murdock, Jr., President of the Pennsylvania Water Works Association—has expressed it thus—Although Mr. Hawley was highly trained as an engineer, and had had years of invaluable experience, he was always eager to learn from all with whom he came in contact. Until the very last he was essentially a young man seeking for new knowledge and new experiences, and he was young, too, in his enthusiasms." In this statement one is reminded that it was seldom that Mr. Hawley ever missed attending a meeting of importance where men of his profession gathered to discuss topics pertaining to water works practices. An outstanding quality of this modest but genuinely big-man of the profession was his willingness to pass on to his associates whatever he could from his own rich experiences. A meeting rarely if ever passed when he was not called to his feet by the presiding officer with the request, "Mr. Hawley, would you give us your experience in this matter?" —or, "your opinion on this question?"; and, it was noticeable that whenever Wm. C. Hawley began to talk he always had something worthy to contribute, and an audience intent. No one realized or appreciated this more than those individuals whose job it is to take notes for preparing reports covering the technical discussions in such meetings, one of whom is the writer of these words of inadequate expression. And it should be added that in association affairs Mr. Hawley has always given generously of his time and many talents, in management, in committee assignments or contributions of technical papers.

Mr. Hawley was graduated by Rensselaer Polytechnic Institute in 1886 with the degree of Civil Engineer. He began his career in the water works of his home town, Cambridge, N. Y., following which his experience was varied—but always in water supply undertakings. In 1896 at 31 years of age he became recognized for his ability and was called to Atlantic City, N. J., to take charge of the Water Department as Chief Engineer and Superintendent. It was this difficult job of keeping such a rapidly growing sea-resort supplied that won him more recognition and the offer of the highly responsible and exacting position of Chief Engineer and Superintendent of the important Pennsylvania Water Company system in 1902. At the time, matters were going none too well for this company, attempting to supply the rapidly growing sections contiguous to Pittsburgh with its many diverse conditions and types of water demand. That Mr. Hawley, with his characteristic conscientious and thorough study of his Company's problems succeeded in solving them, and in building a great system, is now a matter of history. In this, his facility for choosing men for his staff with qualifications similar to his own was a happy one. His ability to hold such men over long periods has been ample proof of his personality, technical soundness, fairness, and able leadership.

To name all of the technical associations of which he was a member would be difficult and too space consuming. The more important were the Am. Soc. of Civil Engrs.; The American, and the New England, and the Pennsylvania Water Works Associations. He was a past president and long a director of the Pennsylvania Association, which made him Honorary Member. He was a past-president and ardent member of the Rotary Club of Wilkinsburg and was a member of the vestry of Calvary Episcopal Church. In his community Mr. Hawley became a highly respected citizen and a congenial leader, all of which went far toward building good will for his company.

Succeeding Mr. Hawley as Chief Engineer and Superintendent is Chas. L. Fox, who has long been Engineer and Assistant Superintendent.

A PORTENTOUS DROUGHT IN THE MAKING

A Study of Nature's Records Indicate as Much

By HALBERT P. GILLETTE

The Author

NOVEMBER 5th daily papers quoted J. B. Kincer, of the United States Weather Bureau, as follows: "Climatologists have considered historic climate as a rather stable thing, with short period variations of considerable magnitude, but without especially significant trends covering long periods. However, since the turn of the century there has been such a persistent trend to higher temperatures, world wide in scope, as to suggest that the orthodox conception of the stability of climate needs some revision at least."

Not all climatologists have believed in climatic stability, and especially those who have relied upon the long records that Nature has kept rather than upon the brief records kept by man. For example, about 25 years ago, Dr. Ellsworth Huntington, of Yale, published his measurements of California "big tree" rings back to 1300 B. C., showing several grand climatic swings. Somewhat later Prof. Gerard de Geer of Stockholm, by using annual silt laminae or varves, showed similar phenomena; and a little later one of his former pupils, Dr. Ernst Antevs, by aid of varves found a cycle of about 1700 years between halts in the retreat of the last great ice-sheet in the Connecticut River Valley. But these important discoveries received then, and still receive, scant consideration by our Weather Bureau which, while spending about four million dollars annually piling up man-kept records, spends nothing measuring tree-rings, varves, rock-strata and other records that Nature has kept. This indifference will ultimately be regarded with amazement.

Six years ago J. B. Kincer (Monthly Weather Review, Sept., 1933) published evidence of long trends of rising temperature and said: "Historic climate has always been considered by meteorologists and climatologists to be a rather stable thing, in marked contrast to geologic climate and weather." He now adds that the recent world-wide change "may be the start of one of the major changes in climate which the earth has not known since geological time, long before any recorded history." So, while conceding that climate is not stable, he clings to the erroneous belief that one must go back to prehistoric geological times to find the counterpart of what is now happening.

In "Climatic Changes" (1922), Huntington and Visher, and in "Climate Through the Ages" (1926), Dr. C. E. P. Brooks, Secretary of the Royal Meteorological Society, published data that completely demolished the ancient belief that climate is stable; so it is surprising to read Kincer's statements that only recently has he begun to question its stability.

First Evidence of Long Climatic Cycles

Perhaps the first publication of convincing statistical evidence of a long climatic cycle of stated length was by T. W. Keele, an Australian civil engineer, in a paper entitled "The Great Weather Cycle" (Proc. Royal Soc. New South Wales, Vol. 44, 1910). Based mainly on flood levels of the Nile since 1736, and partly on Australian rainfall, Keele estimated that his "grand cycle" has a length of about 171 years. Until I secured measurements of Lake Saki

Fig. 1.—Thirty-two Sandstone Beds (Not All Shown) Are Four Ft. Center to Center, with Shale Between. Varves Show that These Sandstone Beds Record Peaks of the 567-Year Cycle. Every Third Bed Is Usually Thicker.

varves that go back to about 2300 B. C., I thought that Keele had overestimated the length of this climatic cycle, but those varves show its length to be 189 years, and its last rainfall maximum in 1870. Curves of rainfall near Boston since 1750, and of Nile flood levels since 1735 roughly confirm the Lake Saki varve maximum of 1870, as shown in a paper of mine on "Varves and Rock Strata as Recorders of Cycles," read June 29, 1939, before the American Meteorological Society, and published in "Roads and Streets," July, 1939.

By measuring varves in stratified rock in the states of California and Washington, Mrs. Gillette and I have been able to determine, with great accuracy, the lengths of a series of dominant triple-progression cycles. These lengths are 7, 21, 63, 189, 1701 and 5103 years. The last two lengths are somewhat less accurately determinable, but there is little doubt that they are exactly commensurable with the shorter lengths which were accurately determined. There are several other triple-progression series of cycles that are subharmonics of this dominant series, and aid in giving it dominance.

The Most Striking Evidence

The most striking evidence of this series of cycles is found in rock strata, such as Figs. 1 and 2, where alternations of shale and sandstone beds occur. One of the most commonly seen cycles in Californian rock strata is the cycle of 567 years, and another frequently seen is the cycle of 1701 years. Based on Lake Saki varves the last rainfall maximum of both of these cycles, and all the lesser ones, was in 1114 A. D. Hence their next minimum of rainfall will be 1964 A. D. But bad as that prospect is, it is not the worst in store, for the 5103-year cycle will then have its rainfall minimum also! Hence the drought that faces the arid and semi-arid regions of America will be the longest and worst since the one centered about 3139 B. C., or since the building of the great pyramids of Egypt.

Since 1870 the rainfall on our Pacific Coast has declined greatly, but believers in the stability of climate have confidently assured the public that a change is "right around the corner." There will be a change, but it will be one for the worse, much worse, where winter rainfall prevails. In America only one city has rainfall records more than 189 years old, namely Charleston, South Carolina. Its records by months start in 1738. The six driest months (November to April) of 1927 to 1938 show a decrease there of 23 percent in rainfall as compared with the mean of the corresponding six months from 1871 to 1922. At this rate of decrease, the six driest months in 1964 in Charleston will show an average of 40 percent less than the 50-year average from 1871 to 1922. It will probably be drier than that, for as dryness advances it tends to increase rapidly.

Fig. 2.—Eight Sandstone Beds Seventeen Ft. Center to Center Record Peaks of the 1701-Year Cycle, as Shown by Varves. Most of the Beds Are Concealed by Detritus and Brush. Every Third Bed Is Usually Thicker.

Cyclic effects are most severe in arid and semi-arid regions. Hence California and the states directly to the east, as well as the eastern parts of Oregon and Washington will suffer exceedingly. At least since 1880 the declining flow of the Columbia River has shown these cyclic effects. The rings of pines in eastern Oregon began to decrease rapidly in thickness 22 years ago, and for the last 15 years have averaged less than two-thirds of their annual thickness. In recent years many articles have been published showing that since about 1870 rainfall in our Pacific Northwest has had a downward trend, relieved only for short periods. The same is true in California. Last winter the snowfall in the Sierra Nevadas was but half of normal, and the outlook for this winter is even worse.

What of the Colorado River Supply?

The great 240-mile aqueduct has just begun to deliver water from the Colorado River to a reservoir in Southern California. At the ceremonies attending the completion of this project it was stated that Los Angeles and the neighboring region will have an abundant water supply for a population several fold that of the present. This estimate of yield is based, of course, on runoff and rainfall records, some of which go back about 70 years when rainfall was most abundant, the theory being that no unusual cycle is in prospect. Yet such a cycle has been proclaiming its existence in man-kept records for 70 years, and in Nature's records it discloses itself again and again through the ages!

Therefore, estimates of future flow of the Colorado River based solely on past records of man are worthless. It need not be surprising if the great reservoir above Hoover Dam goes entirely dry within 25 years.

No thoughtful man can look at the accompanying photographs and entertain a reasonable doubt that long climatic cycles of great up and down swing have occurred repeatedly in the past. It may be questioned whether such cycles still exist, and whether, if existing, I have dated their dry and wet epochs correctly. As to their continued existence Lake Saki varves give overwhelming proof and those varves also supply the best known means of dating their epochs. Many another lake doubtless has similar varves that tell a similar tale. Lake Mono, in California, is known to have annually varved sediments in its bottom; and its shores show terraces that mark periodic halts in the shrinkage of its waters. Even better evidence of such cyclic halts is shown by the terraces around Pyramid Lake, Nevada. In the Pan-American Geologist, March, 1939, I have given estimated lengths of those terrace cycles.

Geologists interpret the ancient by the recent past. Hydraulic engineers should reverse this process and thus be led to forecast future regional dry and wet epochs by using cycles that sediments disclose. To do so will mark, I believe, one of the major advances in the science of hydraulic engineering.

A SEWAGE SCREENINGS PROBLEM

And How It Was Solved

By ORIE G. HENDRYX
Superintendent
and
KINGSLEY CARRINGTON
Chemist
Bloomfield and Normal Sanitary District
BLOOMINGTON, ILLINOIS

FOR ten years we cleaned our bar screens by hand with a long handled rake. This operation took about an hour's time on every eight hour shift during average flow conditions. Of course, in the Fall when leaves are coming down and during stormy weather it took more time. Sometimes we had to keep one man on the job all the time. This work and muss is all eliminated now that we have a mechanically cleaned bar screen.

We have combined sewers within the Bloomington Normal Sanitary District and for that reason we get trash off the streets and alleys during wet weather. Our worse flow of trash comes in October and November when there are a good many leaves washed down the street drains. Other large flows sometimes come when it rains after a week or two of dry weather. We have to be prepared for these periods and our bar screen was designed with this in mind.

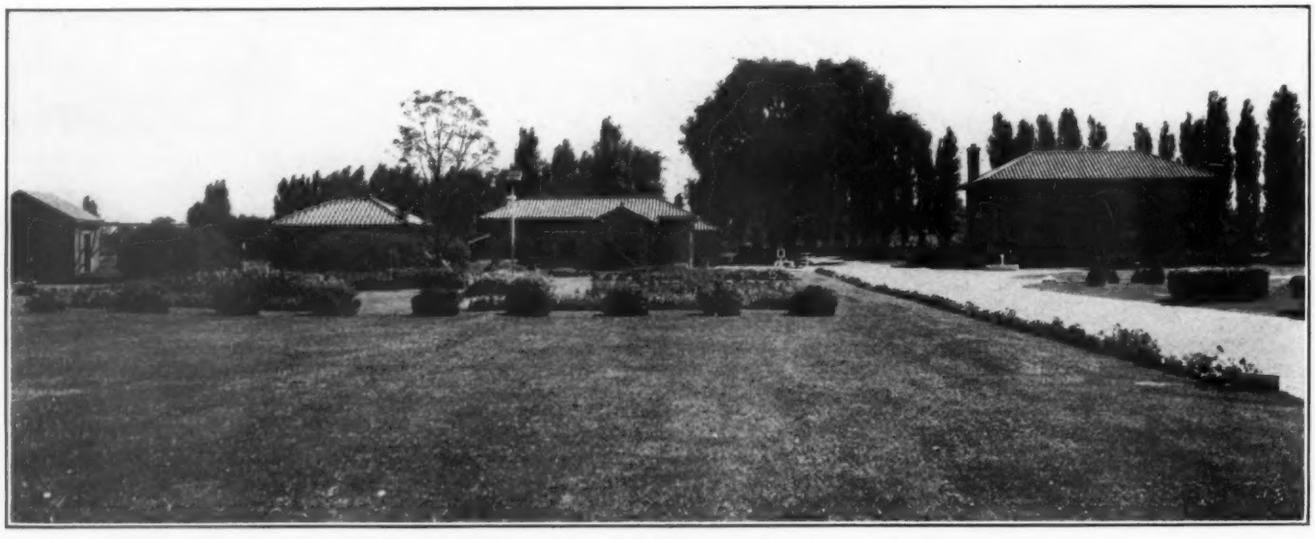
Automatic Cleaning

The bar screen referred to is a "Rex"-Chain Belt Screen. It is 5 feet 7¾ inches wide and the bars 6 feet long spaced one inch apart. It is sloped 30 degrees off perpendicular. There are two flights or rakes, and the chains to which they are attached make a complete revolution in 7 minutes, that is, the bars are cleaned twice in seven minutes. Two timing clocks and a pilot switch are provided and set so that the screen is cleaned by two flights once every hour, or once every two hours, as desired. Another pilot switch is provided to run the screen continuously if need be. The timing devices may be set for any interval suitable for the kind and amount of trash to be handled. The above mentioned time intervals, however, have been found satisfactory for our conditions.

Our average daily pumpage for the period from June, 1937 to June, 1938 was 4,440,000 gallons and for the year June, 1938 to June, 1939, 4,345,000 gallons. The maximum pumpage for the two year period was 8,890,000 gallons. The amount of rainfall and the pumpage seem to have a direct bearing on the amount of screenings that we get. Although the total amount of rainfall for a year is no criterion for judging the amount of trash that is likely to come down. The rain fall for the years beginning and ending the first of June, 1937-38 was 33.3 inches and 1938-39 was 33.1 inches, while the ten year average is 35.16 inches. When rains come that amount to about one inch of rainfall per day, there is more screenings in proportion than when the rainfall is less, of course, there is an upper limit to this, too.

It is interesting that melting snow seems to increase the flow of screening more than a rain of similar water content. This is probably due to the fact that the ground is frozen under the snow in most instances. From the data that we have collected at this Sewage Treatment Plant, we do not believe that any fixed rule can be made by which one could predict the amount of screenings that would come down to the plant under any certain set of natural conditions. At one time we got a rain which amounted to 3.11 inches of water in 24 hours. We had to bypass a lot of run-off water and our record shows only 0.25 cubic yards of screenings for that day.

The following table will give you an idea numerically of the quantity of screenings we handle in terms of cubic yards.



Plant of the Bloomington and Normal Sanitary District

On right—Administration Building, housing laboratory, shop, offices and sewage pumps. Screen House and Grit Chamber in center

Month	1937-38 Total	1937-38 Max.	1937-38 Min.	1938-39 Total	1938-39 Max.	1938-39 Min.
June	13	.75	.25	13	1.0	.25
July	10	1.75	.125	12	1.25	.25
August	11	1.75	.125	15.5	1.5	.125
September	11.5	2.5	.25	13.5	1.25	.25
October	15	3.5	.25	13.5	2.5	.125
November	10.5	1.25	.25	17	2.25	.25
December	6	1.25	.125	13.5	2.0	.125
January	8	1.	.25	11.	1.	.25
February	8	.75	.125	9.5	1.	.125
March	10	.75	.25	11	1.25	.125
April	5	.5	.125	11.5	1.25	.125
May	11	.75	.125	13.5	1.	.25
Total	119 cubic yards			154.5 cubic yards		

The maximums and minimums above are for a single day of 24 hours.

Our ten year average for screenings is 130.4 cubic yards per year. This amounts to about 0.38 cubic yards per day over that period or 0.08 cubic yards (2.16 cubic feet) per million gallons.

Disposal Nuisance Solved

In previous years we buried our screenings, under grit and sludge, in a pit left after the creek was dredged and straightened. We now put most of the screening back into the sewage through a "Rex" No. 3 Triturator. This piece of equipment has proven very satisfactory. We can put about one cubic yard of average screening through the Triturator in an hour's time. The pan in which the screenings are dumped will hold approximately one-fourth of a cubic yard when level full. This has been ample storage space for a day's screenings under average flow conditions. However, as we run on a three shift basis, we have made it a practice for each operator to run the screenings collected on his shift through the Triturator at the end of his time. This was done so that they could pick out the tin cans, golf balls, coal, rocks, and similar material more easily, when the pan was not so full. As a result of this, we have not yet had to change the teeth in the grinder for sharpening, nor make any repairs whatsoever. However, the machine will handle most of the debris mentioned above, if one so desires.

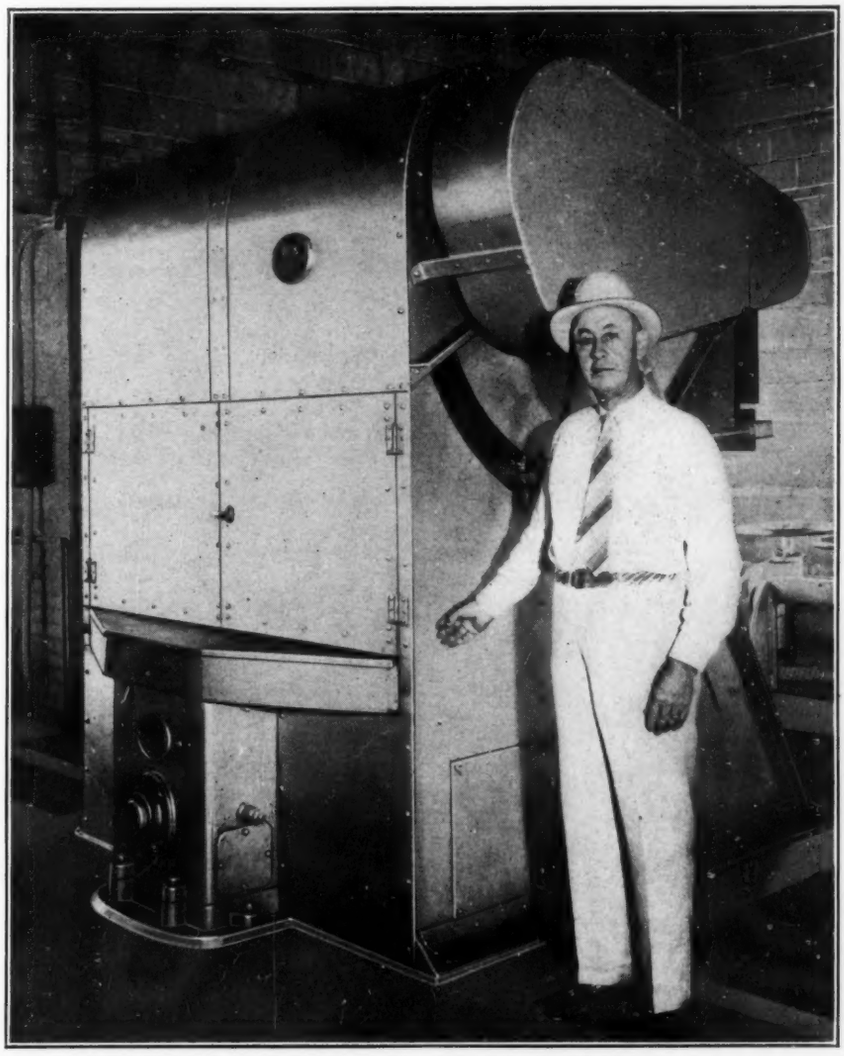
We have noticed no bad effects of putting screenings into our Imhoff tanks. We always have had quite a little floating sludge on our gas vents and there is a possibility that the screenings have made a slight addition to this sludge. But we have to skim the gas vents three or four times a year anyway, so we see no disadvantage to putting them into the tanks.

Operating Costs

The cost of operation of the Rex Screen and Triturator is very small. The triturator costs 3.8 cents per day to run, and the automatic bar screen 2.8 cents under average conditions. We have our own water supply so that the water used during trituration is negligible. When one figures that the machine saves on the average about two man hours per day over the old method of cleaning screens and disposing of the screenings, it seems evident that the change is well worth while. The old method cost about $625.00 per year, while the new automatic bar screen and triturator method costs $250 per year including the time of the operator.

This method of disposing of the screenings is more sanitary, since the operator has very little occasion to touch or handle them. The screenings are always under cover and there is no odor, or muss around the screen.

We are thoroughly satisfied with the Rex Screen and Triturator. Our screenings problem is now under control, and, we do not see now how we ever got along without this equipment, which handles the most objectionable materials that a sewage treatment plant operator has to contend with.



Our Rex Bar Screen and Triturator Unit

—Photo by Courtesy of Chain-Belt Co.

[The gentleman in the picture is the senior author.—Ed.]

LONG ISLANDERS GATHER AT GLEN COVE

For Another Interesting Quarterly Meeting

"LARRY LUTHER'S Long Islanders"—otherwise the L. I. Section of the N. Y. State Sewage Works Association—held another of its fruitful quarterly afternoon and dinner meetings on December 14, 1939.

L. L. Luther
Secy.Treas.
Sup't. Public Wks.
Freeport, L. I.
(On his shoulders rests the organization — and what shoulders.)

John F. Lange
Commissioner of Works
Glen Cove, L. I.
(Host-Chairman, who fought for plant betterments.)

In keeping with custom the clan gathered at the selected sewage treatment plant during the afternoon, for the purpose of inspecting the works and putting its manager and operators "on the spot" in respect to "Why this?"—"How's that?"—"What do you do about so and so?" etc., etc. Then, later at the evening dinner session it's "open season" when the "Question Box" is tapped and those unsigned questions are sprung concerning anything and everything that anybody or everybody wants to ask. Here the local manager may really be on the spot. Incidentally, his knees must be good and strong on another score, because he must also serve as the "Chairman of the Day," although he does have the support of the broad pair of shoulders on his right—none other than those of the organizing and continuing Secretary-Treasurer, Lawrence Luther, who has energized the Section since 1934, when it was begun with 24 members and has since steadily grown to the 135 it now can boast.

Glen Cove the Host Plant

The meeting got under way following the afternoon inspection of the recently revamped and modernized treatment works of Glen Cove, L. I., where John F. Lange, Commissioner of Works; Harland N. Phillips, Plant Sup't., and Fred. Biele, Consulting Engineer, constituted the joint "Reception Committee" and "Bureau of Information." At the dinner session, Host-Chairman Lange took some pride in relating how Glen Covers wanted to spend money for anything but the sewage treatment plant and how he had inch-by-inch gotten this and that betterment or addition approved, and never seemed to end up without having to find a little more money to complete each successive betterment.

Guest Speaker and Leaders

A. F. Dappert, N. Y. State Dep't. of Health, Albany (Guest Speaker.)

Clarence MacCallum, Cons. Engr., Port Washington (Conducted the Question Box Hour.)

George Andersen, Sup't. of Sewerage, Rockville Center. (Arranged and *conducted Special Topic Session; is Vice President of the State Association.*)

As guest speaker, A. F. Dappert, Principal Assistant Engineer of the N. Y. State Dep't. of Health, came down from Albany to talk on the topic—*"Your Job and Security,"* wherein the insecure status of the Sewage Works Operator in times past was brought to mind, and now the greater security of positions which the two-year-old regulation of the State Health Department, requiring political subdivisions to employ only Certified Operators for responsible positions in managing and operating sewage treatment plants in New York State, had brought about.

Mr. Dappert stressed the value of the certification requirement in raising the level of sewage works operators, through the requirements of proven knowledge necessitating study and training at short schools, plus ability. He then cited case histories,

Directors

Herbert O. Johnson, Sup't. Belgrave Sewer Distr., Great Neck, L. I. (Elected at this meeting.)

Joseph M. Ketchum, Sup't. of Sewers, Northport, L. I.

Rodney E. Cook, County Sanitary Engr., Riverhead, L. I. (Also a Director of the State Association.)

wherein worthy operators who had qualified, and had demonstrated interest and ability, had actually been protected. It had been the practice of the Department to issue pointed notification of operator certification requirements to incoming administrations at the time when political plums are usually passed out and worthy men find themselves without a job for no valid reason other than favoritism.

Sam Barasch, Tapax Mfg. Co., Mamaroneck, N. Y.

H. N. Phillips, Plant Sup't., Glen Cove, L. I. (Showed off his revamped plant.)

Wm. S. Hults, Jr., Commissioner of Sewerage, Port Washington. (Used to play around the sewage plant when a boy; the "vaccination" given by Sup't. Hamm, still on the job, "took.")

An important revelation made by Mr. Dappert are the implications in a recent decision of the N. Y. Appelate Courts, that operators of water and sewage plants rightly belong under Civil Service, and what this means in respect to qualifications of the individual and security of position. The net result may well be that the Operator Certification Code will be in large measure responsible for an even higher form of security to plant operators—namely, bringing on Civil Service protection. It seemed probable that the Code will be completely and effectively superseded, thereby. (If so, the "tool" will have done more than the "tool maker" had expected of it.—Ed.)

P. C. MacCallum, Cons. Engr., Mineola. Harry M. Monsell, Sup't. Water and Sewerage, Greenport. (Longest distance traveler to meeting, came all the way from the tip of the Island.)

Francis Bun, Chem. Engr., Monsanto Chemical Co., St. Louis, Mo. (Offered some helpful suggestions in Special Laboratory Session.)

Operator's Round Table

Chairman—C. George Andersen*
Sup't. of Sewers
Rockville Center, L. I.
(*1st Vice-Pres., N. Y. State Sewage Works Ass'n.)

Topic—*Laboratory Control*

This feature of the program, the first attempted by the Section, proved of such interest and worth to operators that it was voted to make it a regular feature of future meetings. It was effectively conducted by Mr. Andersen after the fashion of an Operators' Short School, in which questions were freely asked and answered by those in the group who knew the answers—frequently assisted by clarifying questions and remarks from the Chair.

The first session dealt with the questions "Why Laboratory Control?"—"How Can Such Control Help the Operator?"—"The More Essential Tests and How Conducted." Space limitation prevents a recounting of the full discussions of the Imhoff Cone Test—Residual Chlorine—Suspended and Total Solids. However, it was developed that residual chlorine in prechlorination practice had no deleterious effects on subsequent sludge digestion and, in fact, seemed to benefit digestion wherever a comparison had been available. In making suspended solids test (exactly described) it was developed that the full 200 c.c. sample was not required so long as enough solids to weight 10 or more milligrams was collected on the asbestos matte in the Gooch crucible. To save time and watching in order to avoid a crucible going dry, the sample flask might be fixed inverted with neck below the crucible rim. As the crucible emptied more sample automatically came down without overflowing the crucible. Ignition of the asbestos matte speeds the filtering rate. Those with such experience favored the Alundum crucible—particularly where ash determinations are made.

At intervals operating practices came into the laboratory control picture and these will be covered in the "Question Box Hour" where similar questions were propounded and discussed.

Officers Elected:

Following the dinner the election of officers for 1940 returned Lawrence Luther as Secretary-Treasurer, with acclaim.

Herbert O. Johnson, Sup't., Belgrave Sewer District, Great Neck, L. I., was elected a Director. (The Section runs without a Chairman other than the "Host-Chairman of the Day" who presides at meetings featuring his particular plant.—Ed.)

"The Question Hour"

Conducted by Clarence MacCallum

Consulting Engineer
Port Washington, L. I.

In the "Question and Answer Hour" the following topics were dealt with as the result of questions placed in the always interesting "Question Box"—which itself never questions the identity or motive of the questioner.

Q.—Is recirculation of sludge in digestion units patented?

A.—Mr. Kivell of the Dorr Co. was called upon for an answer. He replied—yes, but explained that the patents of Dr. Imhoff had now expired.

Q.—What is the proper solids content of sludge going into digesters?

A.—Crude sludge 8 to 10%; crude and activated mixed about 7% was

Peter Kelly, Sup't. of Sewerage, Hempstead, attending his first meeting with Leslie S. Marshall, Hempstead's Village Engineer.

the best that could be secured even with the intermediate thickening in small concentrating tanks.

Q.—What is an effective digestion period?

A.—In heated digesters held around 85° F., about 40 days or less—the only criterion being that period required to produce a product

Fred Biele, Cons. Engr., Huntington. (Immediate past-president of the State Association.)

Wm. Kennedy, Chief Operator, Huntington.

A. P. Scudder, Chemist, Rockville Center.

without offensive smell and good drainability. Usually properly digested sludge will analyze 45% ash and 55% volatile matter on the dry basis.

Q.—Can one tell how well sludge is digested by pH tests? Are lime additions necessary?

A.—No. There is no relationship between digestion progress and pH, except that a sludge which becomes acid (pH below 6.) will not digest until corrected by lime addition. Lime is not needed if fresh sludge is *kept fresh* and not allowed to remain in the clarifier too long. A properly operated digester will not require lime after the initial acid digestion period, always experienced in starting digesters has been passed through. A sludge never allowed to go "sour" by using lime, will never require as much lime as one that must be brought back after it has gone sour.

Q.—What is the best digestion temperature?

A.—Long Island operators agree that 85° to 90° F. is the optimum range and 75° F. the minimum. The secret was to hold to the selected

"Tablers"
Head, and Otherwise—70 in All.

temperature as closely as practicable. Operating with temperatures varying over a range had proved deleterious. The quality of supernatant liquor had seemed about the same at all temperatures between 85° and 100° F.

Q.—What has proved the most successful method of thickening activated sludge or mixed crude and activated sludges?

A.—At the Tallmans Island Works of New York City, Mr. Shapiro, Chief Chemist, reported that some recent success had been had in concentrating thin activated sludge in continuous flow circular units, having conical bottoms and a picket fence thickening mechanism. Successful concentration involved 4 to 5 hours holding and a deep sludge blanket. To maintain the latter, and preclude septicity and bulking, it was necessary to slow down biological action. To do so chlorine water applied through a distribution grid submereged below the water surface a few feet maintained 1 to 2 ppm. residual chlorine in the supernatant liquid—no residual being required in the sludge proper. The ratio of chlorine had been 0.03 to .04 lbs. per thousand gallons of excess sludge wasted to the thickeners. Entering with only 0.5% solids the sludge had been concentrated 6 times—i.e., to 1/6th the original volume—without difficulty, and at times even to a higher concentration. Trials now under way involved adding lime to the chlorinator discharge and applying the resulting slightly alkaline hypochlorite (very dilute) with efficient mixing to the whole of the sludge entering the thickener. Such was expected to form mildly antiseptic chloro-proteins and chloramines from the free and albuminoid ammonia naturally present. The attempt was being made to secure effective antisepsis throughout the complete depth of sludge blanket and thus avoid over-chlorination of the very top sludge in order to obtain depth effects, which the top water chlorination scheme seemed to require.

Q.—What method of sludge concentration is practiced at the Rockville Center Activated Sludge Plant?

A.—From George Andersen, Sup't., it was learned that 3% solids could be had from final clarifiers during cold weather and proper setting of withdrawal orifices. In warm weather the much thinner sludge is concentrated in thickening tanks, by adding 90 to 100 ppm. of chlorine in solution to the wasted sludge and decanting supernatant.

One of the best meetings ever held by the Section closed with a discussion by C. B. Kelly (N. Y. Dep't. of Health) of proper sampling methods and sampling schedule for sewage, effluent, and sludge. This topic we understand is to be the subject of the next "Operators' Round Table" since time did not permit dealing with the topic effectively.

WATER UTILITY REGULATION AND DELAWARE RIVER WATER SUPPLY

Featured at N. Y. Section Meeting

Frank Henshaw
Chairman

The New York Section of A.W. W.A. held its annual half-day nual half-day Winter Meeting in New York City on December 28, 1939, under the chairmanship of Franklin Henshaw, Superintendent of Water Dep't., Scarsdale, N. Y. Speakers at the luncheon included Secretary Jordan, who spoke on the rapidly maturing plans for the Kansas City convention, and "Bill" Orchard who enlarged enthusiastically on the extensive technical program being developed for that meeting.

Following the luncheon three papers were presented:

"Centralized Laboratory Control for a Group of Privately Owned Water Supplies"—by John S. Kneale, Chemist, New York Water Service Corporation, Brooklyn, N. Y.

In the several plants under supervision of this organization, filtration is not always required, but corrosion control, removal of iron and manganese, and difficulties due to iron bacteria require special study. Centralization of laboratory facilities permits the use of more elaborate equipment, expert interpretation of analytical results, and capable supervision of plants, said Mr. Kneale.

"Regulation of Water Utilities in New York State"—by Major Arthur H. Pratt, Chief Hydraulic Engineer, Public Service Commission, New York, N. Y.

Major Pratt ably reviewed the many functions of this Commission, under whose jurisdiction come 107 separate water companies operating 125 plants. The establishment of an equitable state-wide rate schedule has involved 66 legal cases with 400 hearings. Some 144,000 water meters are concerned and meter testing requirements have resulted in greater accuracy. More than five years work was required to evolve the uniform system of accounts ordered by the Commission and upheld by various courts.

"Delaware Water Supply for the City of New York" — by Leonard P. Wood, Engineer, Board of Water Supply, City of New York.

Mr. Wood revealed that the Delaware River project has included contracts totalling $170,000,000 to date, and is progressing well ahead of schedule. The comprehensive data, supplied with reference to the necessary dams, water storage, and 137 miles of tunnels which will bring water to the city, is beyond the space limitations of this report. Of especial interest was the discussion devoted to construction methods employed in the two pressure tunnels. These are necessarily deep where crossing under the Hudson River (600 feet below sea level at this point) because of geological faults and rock decay. Elaborate ventilating equipment is provided, since this is the pioneer construction for study of silicosis prevention under the new State regulations.

A SEWAGE WORKS CONVENTION OF NATIONAL PROPORTIONS

In Which America's Oldest Sewage Works Association Will Celebrate Silver Anniversary

TO celebrate a quarter century of service to sewage works operators, a three-day convention of national complexion is being planned by the New Jersey Sewage Works Association, which holds the distinction of being the oldest sewage association in the country. This convention is to be held in Trenton, N. J., March 20, 21, 22, 1940, with headquarters at the Stacy-Trent Hotel.

Membership in the Association, including men of prominence from many other states, now totals 246. Plans under way for the New Jersey Silver Anniversary Convention are based on an anticipated attendance of 400 or better, to hear from men of national prominence on the program and to see the extensive exhibits of sewerage equipment and materials planned for the occasion.

W. J. Orchard, who has taken on the job of serving as the "mainspring" of the Silver Anniversary Committee, says "Count on it; it's going to be the biggest 'Sewage Works Show' ever put on." He is assisted by H. P. Croft, as Vice Chairman and seven other sub-committee heads. The endorsement of Dr. Lynn J. Mahaffey, State Director of Health, is had in his acceptance of the Honorary Chairmanship of the Committee.

Some History Made

The New Jersey Association, forerunner of similar associations in other states, was organized in 1915 by a group of twelve far-sighted men.

Significantly, officers of the association for the full twenty-five years of its existence have without exception been operators of sewage treatment plants.

(It is worthy of note that Paul Molitor, Sr., second president of the association, has given to it two sons to "carry on" as sewage works managers and association wheel-horses. The first son, Edward Molitor, is now its president, and Paul, Jr., is assistant secretary and treasurer.—Ed.)

Just three years after its organization, through an act of the 1918 legislature, the State of New Jersey became the first in the Union to require operators of sewage treatment plants to qualify through written and oral examinations as to their fitness to handle such plants. Recognizing the premium thus placed on training, the New Jersey Association is believed to have been the first to initiate short courses in sewage treatment for the benefit of operators. At present it is setting up precise standards for protection against fire and explosion hazards in the handling and utilization of gas. These and many other constructive works have benefitted, and will continue to benefit, municipalities of New Jersey and other states as well through its widely distributed publication, "Proceedings of the N. J. S. W. A."

Convention Plans

The Silver Anniversary Convention will open with a group luncheon at the Stacy-Trent Hotel on Wednesday, March 20th, where New Jersey's water and sewage-minded Governor, A. Harry Moore, will make the principal address. Other speakers to be heard will be Dr. Lynn Mahaffey, State Director of Health, followed by the first president and secretary of 24 years standing, John R. Downes. Wednesday evening there will be an informal get-together and smoker and for Thursday evening there is scheduled a large dinner and special entertainment of fitting proportions.

Guest Speakers of National Prominence to Appear

Five technical sessions have been scheduled for the three days. In line with the wishes of the membership, operating papers pointing the way to better all around small plant operation and control will enjoy prominent positions, several being on the program for each of the five sessions.

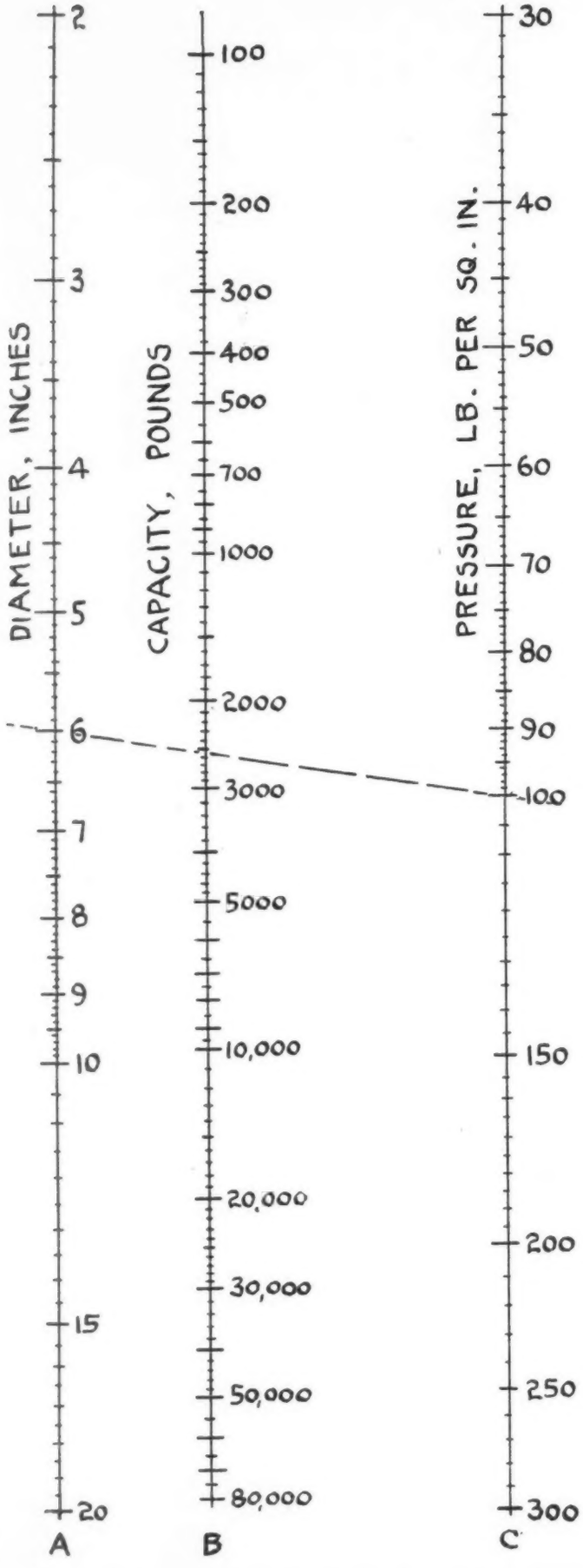
A number of outstanding engineers and chemists from other parts of the country have agreed to participate in the special program and present papers. Among these are, Dr. F. W. Mohlman, Chicago; Abel Wolman, Baltimore; Paul Hansen, Chicago; George Gascoigne, Cleveland; and Dr. Max Levine, Ames, Iowa; Wellington Donaldson, Frank Bachmann and Linn H. Enslow, all of New York. The completed report of the Committee on Gas Hazards at Sewage Treatment Plants, (available to members in advance), is to be presented and opened up for general discussion.

Equipment Exhibit a Feature

The largest Manufacturers' Exhibit in the history of sewage works conventions is anticipated. More than double the usual floor space is being provided by leasing the entire ground floor of Trenton's new War Memorial Building, located directly across the street from convention hotel headquarters. In the same building will be the registration desk and meeting rooms. In charge of exhibit arrangements is a man who has had long and valuable experiences in handling such exhibits for the American Water Works Association and other groups.—Charlie Becker.

The Silver Anniversary Committee, headed by W. J. Orchard, as Chairman, and Dr. Mahaffey as Honorary Chairman, consists of Harry Croft, John R. Downes, P. N. Daniels, Linn H. Enslow, Edward P. Molitor, Paul Molitor, Sr., Samuel Probasco and Edward P. Shissler. The following are chairmen of subcommittees: Arrangements and Attendance, P. N. Daniels; Technical Program, Harry P. Croft; Attendance and Publicity, Paul Molitor, Jr.; Manufacturers' Exhibits, Charles Becker.

There is a rumor going the rounds these days that "Bill" Orchard, who for years has taken such an active part in the work of the American Water Works Association, will have something to say at the meeting regarding the need for a strong national sewage works association. If this rumor materializes there will be introduced much "food for thought" at this important meeting, and many voices of prominence should be heard. It may well develop into a movement which will knit the several state and regional sewage works associations into an organization of enhanced strength and usefulness to the greatest numbers.



Hydraulic Power-Lift Chart*

THIS chart will be found convenient for solving a multitude of cylinder problems in connection with water plant machinery. It eliminates all of the longhand figuring that is usually necessary in computing the total pressure on a piston, the capacity of a pressure hoist, the pressure needed to achieve a given lift, and so on.

Thus, for instance, if you have a cylinder that is 6 in. in diameter and a pressure of 100 pounds per square inch, the dotted line drawn across this chart connecting the 6 in column A with the 100 in column C shows in column B that the cylinder will have a lifting capacity of a trifle over 2500 pounds. Thus, simply connect the known diameter in column A with the known pressure in column C and the intersection through column B gives the lift capacity in pounds.

If, on the other hand, it is desired to choose a cylinder to provide a life capacity of 2500 pounds, knowing the pressure to be 100 pounds per square inch, the same dotted line gives a diameter of 6 in. Or, if the available head is only 50 pounds a line from 50 (Col. C) through the 2500 pounds (Col. B) reveals that a piston of 8.5 inches is required.

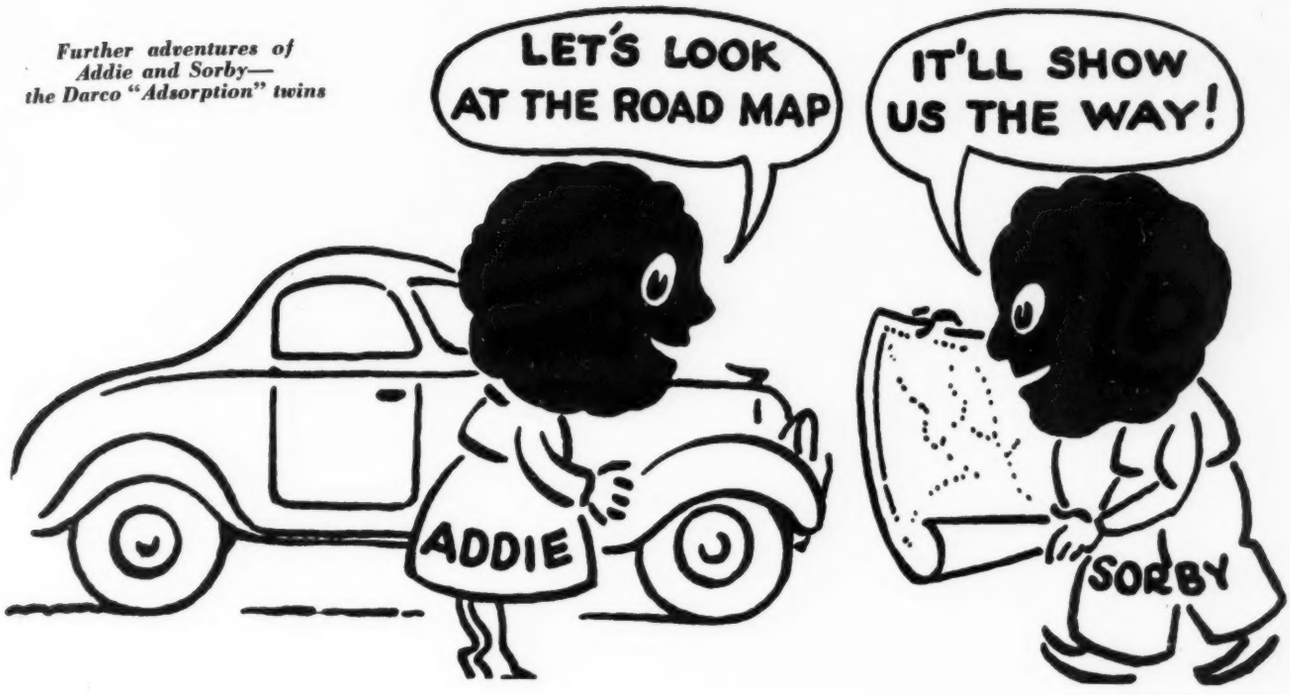
Run a straight line through any two known factors and the intersection with the third line gives the answer. Thus, if you want a capacity of 2500 pounds and you have a cylinder whose diameter is only 6 in. a pressure of 100 pounds per square inch will be needed to produce the desired capacity. If you have an 8-in. cylinder then the pressure need be but 55 pounds—line from 8 in Col. A through 2500 in Col. B.

As will be noted, the chart has a great enough range to take care of any ordinary requirements, the diameters ranging from 2 to 20 in. and the pressures from 30 to 300 pounds per square inch. The lift capacities (Column B) range all the way from 100 pounds to 80,000 pounds, or 40 tons.

The graph is applicable to all of the fluids that are used in work of this nature—air, water, oil, etc.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

Further adventures of Addie and Sorby— the Darco "Adsorption" twins



"Road Maps" for Water Purification

The *Carbon Feed Chart* and *Threshold Odor Tests* are handy, practical "road maps" for waterworks men. They point out the quickest, most economical way to palatability control. They translate all complicated mathematics, and tell at a glance what you want to know.

With these "road maps," you can check shipments for uniformity, and compare the efficiency of different carbons. You can prove that HYDRODARCO gives the best palatability control per dollar!

Use a Carbon Feed Chart and Threshold Odor Tests—and use HYDRODARCO, the activated carbon specially made for water treatment.

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The Editor's Comments

OUR JACKET

BEGINNING with this issue readers will note a rather pronounced change in our front cover designs—two patterns being involved. This we believe to represent a rather effective improvement toward dressing up the magazine, and hope that others will agree. This has not been possible, however, without its cost to us and to a valued advertiser.

For the past two years, at termination of the current yearly contracts with an important manufacturer to carry his advertising on our front covers, we have seriously considered the move to withdraw our front covers from the market. However, this advertiser had so consistently been doing a highly credible job in his use of the covers that each time we decided to postpone the move one more year. In addition, we could but recall that this particular client — The Pittsburgh Equitable Meter Co.—came with us at a time during the late depression "when a feller needed a friend." This important fact, and the consistency of such support since, we just could not lose sight of. And, it is still with considerable regret that we felt that the time had eventually come when we would have to ask them to release their valuable cover position, with the understanding that it would never again be sold. Or, if so, that they would be given first option.

We can only say that we sincerely hope that the loss of the prestige location for their effective advertisements will not result in a single dollar loss in sales for them. We would go further and ask every reader to remember Pittsburgh Equitable when they look at this and future covers of WATER WORKS & SEWERAGE, and urge each to locate Pittsburgh's ad in every issue in which it may appear. We hope, thereby, that this request may result in some compensation for their loss of an established position, which means so much in consistent advertising.

In deciding the policy of discontinuing the sale of our covers we did so with full realization of what the move would cost in revenue loss—possibly, even the complete loss of the full account of a client and, more importantly, of a good friend which came to us in a very blue year. However, the latter did not happen we are happy to say, and we hope some day to prove to Pittsburgh Meter that the positions on the inside of the magazine are more effective than their present appraisal indicates—and, certainly, far less costly for the returns.

We hope that our readers will find the new covers pleasing to them, and also informative in an illustrative way, because in the last analysis it was reader preference which brought us to the decision to take the step. In so doing we have gone to an extra expense in employing a leading designer to modernize the cover pattern. The end sought was that of securing the most effective results with noteworthy photographs, in an effort to make each individual cover outstandingly attractive.

If our readers will take this as an invitation to supply appropriate photographs of water or sewage subjects that they believe will prove interesting or unusual cover illustrations (across the cover or vertical) we shall appreciate the loan of such photographs. A brief description of the cover picture can be run on the inside of the issue, with appropriate reference thereto.

When looking at the cover picture on this issue just remember that it was made and contributed by an amateur, even though it may look very professional.

TO GEORGIANS

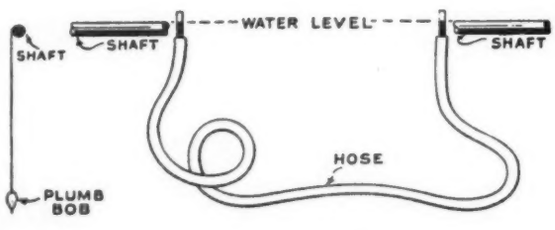
Our most sincere regrets that it has not proved possible up to this time to run the excellent account of the recent meeting of the Georgia Water and Sewerage Operators' Association and proceedings of the successful and growing Annual Short School held in conjunction therewith.

To W. H. Weir, of the Georgia Department of Health, who prepared the splendid report, covering the record-making meeting and America's outstanding short school, and to G. R. Frith, who supplied the excellent snapshots accompanying it, our profound apologies. On the grounds of price commitments and resultant lack of space we offer this explanation and our apology.

L. H. Enslow

Accurate Levelling and Aligning by Simple Method

The accompanying sketch shows how to do it. Slip gauge glasses into each end of an ordinary rubber hose and fill with enough water so that the level will show in each glass, as indicated.



When filling the hose with water, care must be exercised to be certain that all air is gotten out of the hose. Hold it in a U-position when filling. Do not attempt to fill it by immersing the hose in a tub of water. Also, one end of the hose must not be warmer than the other end. If the water in one end is warmer it will occupy greater volume and the level will not be true. In other words, get rid of all of the air and use water of the same temperature throughout.

The sketch also shows one of the simplest methods by which shafting can be aligned. Suspend several plumb bobs from the shaft as shown, all from the same side of the shaft. It is then possible to glance along from one end to the other and one can see whether or not the cords supporting the plumb bob are in perfect alignment. If they are not in alignment, the shafting is not straight and should be rectified. A cord stretched lengthwise near the vertical cords enables one to measure the exact amount of misalignment and assist in making the shaft straight.

MULTI-ZONE FURNACES . . .

For Incineration of SEWAGE SLUDGE, SCREENINGS and GROUND GARBAGE

● *OPERATION IS WITHOUT AUXILIARY FUEL — ODORLESS!*

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MULTI-ZONE FURNACES embody greatly improved principles of multiple hearth furnace operation.

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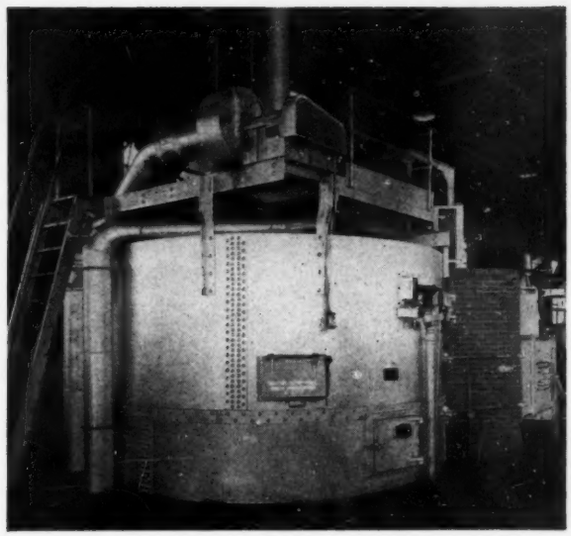

40 ton furnace—Milwaukee, Wis., incinerating screenings and grit.

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EQUIPMENT NEWS

New Circuit Tester by Weston

● A new circuit tester, possessing unusually wide flexibility of use for individual measurements on all types of control and signal equipment, and electronic apparatus, has been announced by Weston Electrical Instrument Corporation, Newark, N. J.

Known as the Model 785 Circuit Tester, this relatively inexpensive device has 27 complete ranges for voltage, current and resistance measurements. Some of its applications include checking sensitive relays, signal systems, remote control circuits, public address systems, amplifiers, interoffice communicating systems; telephone circuits, a.c. and d.c. commercial motor voltages. The sensitivity of the instrument permits voltage, current and resistance measurements on oscilloscope circuits.

The new Circuit Tester provides d.c. voltage measurements at a sensitivity of 20,000 ohms per volt and a.c. voltage measurements at a sensitivity of 1,000 ohms per volt over a wide range up to 1000 and 500 volts respectively; also d.c. and a.c. current measurements in ranges of 0-50 microamperes; and resistance measurements in wide ranges of ohms and megohms. Resistance measurements are obtained in conjunction with self-contained stock batteries.

The instrument accuracy on d.c. voltage and current measurements is within 2 per cent and, because of the new temperature-compensated rectifier circuit employed, a high accuracy on a.c. voltage (within 3 per cent) is permitted.

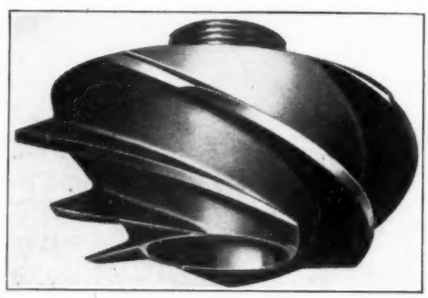
The Weston Circuit Tester employs a standard unicell on all ranges where any appreciable current is drawn by the ohmeter circuit. In addition, two 7.5-volt batteries are used to supply energy for the high resistance ranges only. Since the total drain on these batteries never exceeds 50 microamperes, they have self life.

Weston test leads are supplied with the circuit tester for all voltage and resistance measurements. Binding posts are furnished for current measurements. This arrangement obviates the possibility of using the test leads for current measurements where too high a current might be put through the leads for normal service. The case of this compact instrument measures only 13x12½x5½ in. Complete weight of the device, including the case and batteries, is but 13½ lb.

More detailed information about the new Model 785 Weston Circuit Tester may be obtained by writing Weston Electrical Instrument Corp., Newark, N. J.

Improved Deep Well Turbines by Worthington

● A new line of Turbine Well Pumps has been announced by Worthington. These new units feature the new Vacuum Molded Impellers—the first time this construction has been used in this type of pumping equipment.



Vacuum Molded Impellers are said to be in perfect balance, while the smoothness of the blade surfaces and uniformity of the castings result in high efficiency and greater certainty of performance. Wear or abrasion in the impellers is reduced to a very negligible minimum by the use of hard, high-tensile bronze. Available with either encased oil lubricated or pen water-lubricated shaft bearings, these new turbine well pumps are readily adaptable to individual local conditions.

Important details of construction are illustrated in a new Worthington bulletin. A companion bulletin deals particularly with the novel impeller of special aluminum-bronze alloy, which is cast by drawing the metal from beneath the surface of the molten mass up into the mould by a vacuum. Thereby, the perfect homogeneity and extreme density (hardness) of the casting is secured.

For the descriptive Bulletins H-450, B-29 and B-30, write Worthington Pump and Machinery Co., Harrison, N. J.

84" pipe—Spring Lake, N. J.

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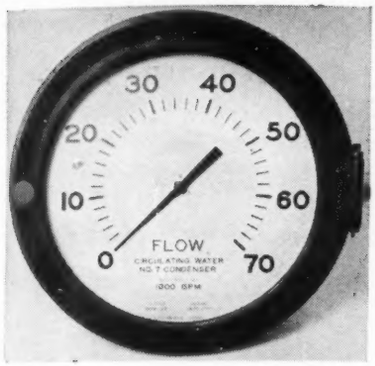
Cochrane Offers Flow Meter For Round Cases

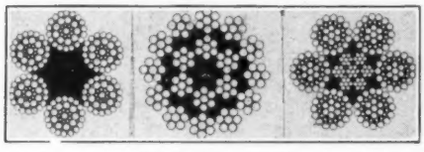


● Most engineers are familiar with the Cochrane Electric Flow Meter, the indicating and recording unit of which is customarily housed in a rectangular panel front or wall case.

Now, to meet a demand for round panel cases, Cochrane announces the availability of such. Ordinarily the rectangular case is 16x17½ inches. The same instrument, in respect to all working parts, is now offered in a round case model to fit cases 14½ inches in diameter.

Standard Cochrane Flow Meters, and the same units for round cases, have distinctive features described and pictured in a new bulletin. For Publication 2096 write Cochrane Corporation, Allegheny Ave. at 17th St., Philadelphia, Pa.

? ? ?



● One would hardly guess it on first glance, but these little geometric figures represent cross sections of three of the many constructions of wire ropes—of which we never realized how many there could be.

This item is out of place here. It should be on the Literature Review page, but we were desirous of illustrating just how the new Hazard Wire Rope Handbook and Catalog reveals the great variety of strandings of Hazard Wire Ropes for innumerable purposes and duties.

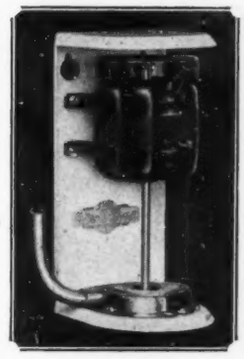
The new pocket size catalog presents basic information on materials, construction and applications of wire ropes in a highly useful manner. In addition it serves as a "Wire Rope Hand-Book", since it contains considerable in the way of useful technical information on splicing, seizing, socketing, types of slings, the care of wire ropes and useful tables.

For a copy of Catalog 20 write Hazard Wire Rope Div., American Chain and Cable Co., Inc., Wilkes Barre, Pa.

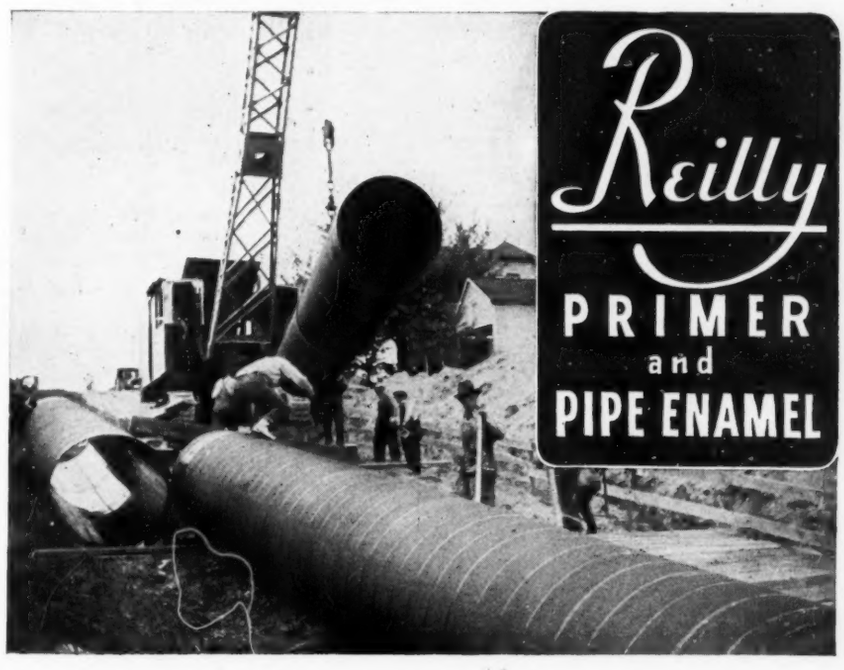
Small Pump of Acid Resisting Construction

● The Air-O-Line Company of Dallas, Texas, manufacturers of fans and pumps for cooling residences and buildings, announces a new small capacity pump of stainless steel construction, mounted on a neat porcelain enameled stand or wall bracket.

The manufacturer claims this new pump to be one of the most efficient small pumps ever developed in the low-price field. It is available in 3 sizes with capacities from 70 to 360 gals. per hour (1/55th to 1/100th hp. motor) against heads up to 8 feet, but zero suction lift. It is especially adaptable for experimental work and small plant scale studies. The prices, starting at $10.00 per unit, seem exceptionally moderate.



For descriptive folder write The Air-O-Line Co., 2118 Griffin St., Dallas, Texas.



Protected INSIDE AND OUT

WITH REILLY PIPE PRIMER AND ENAMEL

For many years Reilly coatings have stood the test, providing dependable protection against rust and corrosion of water works and sewerage pipe, conduits, tanks, pumps and structural metal.

Inner surfaces are protected to prevent incrustation and tuberculation and to insure maintenance of full capacity flow, and outer surfaces are protected against the destructive action of corrosive soils and electrolysis. Reilly coatings are highly resistant to abrasion, and withstand wide variations in temperature without sag, chipping or peeling. They are economical to apply and constitute a sound investment.

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

GONE

The "Blue Thirties" have gone and, we hope, taken their troubles with them. If one of *yours* was Jointing Compound, better get in step with the More Efficient Forties by using Tegul-MINERALEAD, the only such compound with all these advantages:

1—Quick healing. Allows quick back-filling and prompt clearing up of premises.
2—Ingot form—10 lbs. each. Easy to handle, store and ship—as well as to work.
3—Impervious to snow, rain and flood.
4—Can't change composition. Reaches you correctly mixed by us.
5—Makes permanently tight joints that will stand everything the pipe itself "can take."
6—Needs no skilled labor, caulking or deep bell holes.

Isn't this just about everything you've ever *hoped* for in Jointing Compound for Bell & Spigot Pipe? For more information, write The ATLAS MINERAL Products Company of Pa., Mertztown, Pa.

A Tegul PRODUCT

Tegul-MINERALEAD

FERRIC ISCO CHLORIDE

For Sewage and Water Treatment have you tried

• ISCO •

Ferric Chloride . . . . . SOLUTION or CRYSTAL?

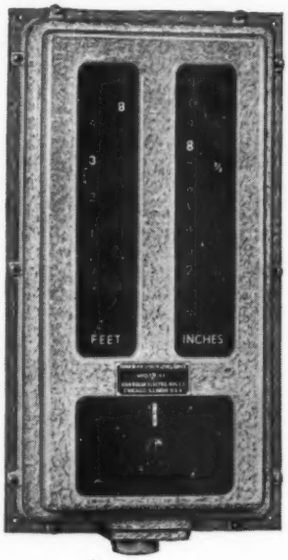
FOR SLUDGE CONDITIONING—Ferric Chloride is accepted as the agent most efficient from the standpoint of performance and cost.

FOR COAGULATING SEWAGE—Ferric Chloride provides an inexpensive and effective method of dealing with plant overloads.

FOR WATER PURIFICATION—Ferric Chloride is an economical and practical coagulant, and gives quick-forming, fast-setting floc. Write

INNIS, SPEIDEN & CO.
117 LIBERTY STREET, NEW YORK, N. Y.
Chicago Cleveland Boston
Philadelphia Gloversville, N. Y.

Remote Indicating Multiple Liquid Level Gauge



● A new remote reading liquid level gauge has recently been announced by Guardian Electric of Chicago, well known manufacturers of electrical controls.

The Guardian Gauge is designed to measure liquid levels in tanks of every type now in use, to the nearest one-eighth inch. It is said to be unaffected by temperature, weather, varying specific gravities, or distance between tanks and control office.

The float operated tank unit consists of a fully-protected mechanism with bronze gears sealed in oil. The oat displaces 1/16 inch of liquid, and operates the transmitting mechanism on as little as a 4-oz. pull.

The single Indicator Panel (see cut), located at central stations, can be connected to any number of tanks or reservoirs. Each tank is gauged by turning a dial to the number of tank to be gauged, whereupon, by simply pushing a contact button, the exact depth lights up on indicator panel. Feet appear in red numerals, inches and fractions in green. The new Guardian remote reading gauge may be used on tanks up to 50 feet in height.

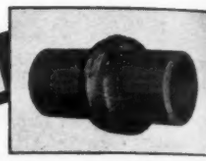
For further details write for illustrated Bulletin G-49. Guardian Electric, 1621 W. Walnut Street, Chicago, Ill.

Interesting Midget Laboratory Pump

● "Just a hand-full of pump" is a fair description of the Midget Model Laboratory Pump being offered by The Chemical Rubber Co. of Cleveland.

This little centrifugal pump is close coupled to the drive motor, the entire 2¾-lb. unit fitting in the palm of one's hand. It is powered by a 1/20th H.P. motor for pressures up to 30 lbs. and

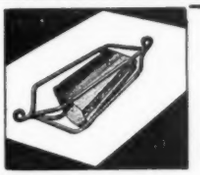
WESTON



GASKET AND FORM
The Perfected Method for Making SEWER PIPE JOINTS OF CEMENT

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON Adams, Mass.



COMPLETE SEWER CLEANING EQUIPMENT

If you need a sewer cleaning machine, sewer rods or sewer cleaning tools, don't fail to investigate our complete line before buying. Machines sold or leased. Sewer rods and hand tools sent on free trial.

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Jacksonville, Fla. P. O. Box 581
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EDSON'S NEW HAND PUMP

Smallest Diaphragm Pump Made, 2" Suction Open Discharge. Capacity 1400 G.P.H. Weight 50 lbs.

THE EDSON CORP'N
49 "D" Street
So. Boston, Mass.
NEW YORK: 142 Ashland Pl., Brooklyn
CHICAGO: 1061 Peoples Gas Building

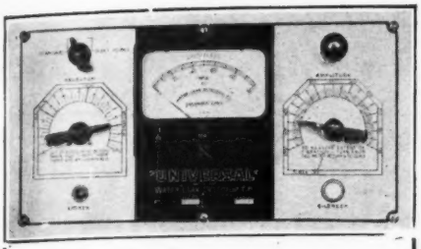
Catalog "T" Gives Full Data, Also Edson Hand and Power Pumps, Suction Hose and Pump Accessories

PATENTED

Quick Easy Lasting

TAPAX is the surest relief from rattling, banging manhole covers and offers you the simplest solution for noisy covers at a cost of comparatively a few cents an application. It will "stay put" for years. Ask for sample.

TAPAX MFG. CO., INC.
MAMARONECK NEW YORK



WATER LEAK

detection and location problems have been satisfactorily answered by many practical water works men, since they abandoned the old fashioned listening devices, and adopted the modern and up-to-date

"UNIVERSAL METHOD"

of locating leaks, which measures leak vibrations on a visual meter. As these vibrations increase or decrease, the operator knows he is going towards or away from the leak. Likewise, he knows when he has spotted the leak.

We train your men the "Universal Method" at no extra cost.

PIPE LOCATION:—Since no one type of pipe locator will locate all pipe and fixtures under all conditions, therefore we manufacture two types. Our Energizer type locates pipe under reinforced concrete pavements. Our T-R type locates pipes, short stubs, tees, crosses and buried valves, etc.

Why not write for illustrated literature, or better yet, ask for a demonstration in your own city.

WATER LEAK DETECTOR CO.
166 N. Third Street
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Tested

Protective Bituminous Surfacing Products

HYDRO PROOF

For surface repairs and protection on all reservoir tops and walks and on floors of every nature.

HYDRO PROOF Plastic

Fine quality plastic joint material for sewage pipes. Saves both time and money in the production of tight joints.

SILVER SEAL Aluminum Paint

An exceptionally durable, long lasting decorative coating. Ideal as an illuminative finish at danger points.

BLACK SEAL Anti-Rust Paint

An unusually tough and elastic finish. Waterproof, fume-proof, anti-corrosive and possessing extraordinary durability and resistance to dampness and other destructive elements.

Write us for Booklet W.

ASPHALT PRODUCTS CO., Inc.
Eastwood Station Syracuse, N. Y.

delivery up to 8 gpm. A 1/100th H.P. unit (same size) is good for a delivery of 5 gpm. against pressures up to 10 pounds.

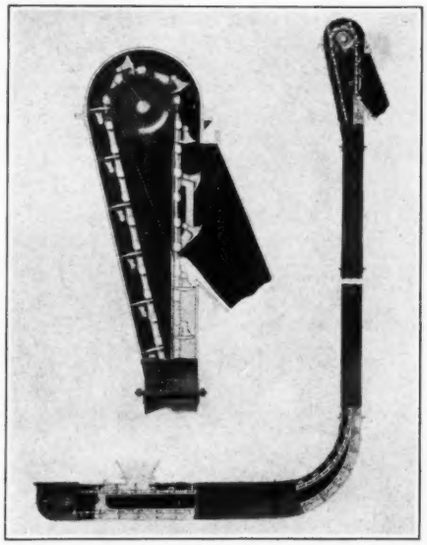
The Midget Pump is available in monel metal, bronze, or other alloys as specified. The prices are as attractive as are the possibilities of the unit for experimental or general laboratory use.

For illustrated leaflet write The Chemical Rubber Co., W. 112th St. and Locust Ave., Cleveland, Ohio.

New Jeffrey Elevator Conveyor

● One of the first pieces of new equipment for 1940 is the MASS-FLO elevator-conveyor just announced by The Jeffrey Manufacturing Co. This new unit offers a low cost and unique method of handling all kinds of granular materials such as chemicals, coal, gravel, sand, etc.

The Jeffrey MASS-FLO is simple in design and construction, consisting of a steel casing through which solid pivoted flights, spaced at intervals on a single strand of chain, move the material horizontally or vertically in a solid mass or with partial load.



The enlarged view of the discharge point shows how the load is discharged from the flights by means of the tripper. Since each flight of the MASS-FLO carries a full or artial load, depending upon rate of feed, the unit completely empties itself after each service.

The new Jeffrey elevator-conveyor handles material with very little agitation, thus dust production, breakage, and degradation are practically eliminated. This new unit is low in initial cost and requires small installation space. It is self-feeding and self-cleaning.

These and other features, as well as drawings showing various arrangements, are embodied in literature, describing the MASS-FLO Conveyor, which may be had by writing The Jeffrey Manufacturing Co., Columbus, Ohio.

When You Specify

Meters and Recorders

Be Sure To Demand

● ACCURACY ● RELIABILITY
● SOUND ENGINEERING
● MODERN APPEARANCE

Regardless of whether your problem calls for the use of a Venturi Tube, Weir, or Flume, you can depend on Bailey Meter Company to design and construct both the primary element and the register for maximum accuracy.

A vast amount of experience gained from thousands of installations of metering equipment, together with extensive experimental work in our own hydraulic laboratory and in the laboratories of the Ohio State University, Cornell University, Case School of Applied Science and other institutions, is back of every Bailey Primary Element.

The reliability of Bailey Meters and Recorders is attested to by the fact that thousands of dollars worth of steam and water are sold monthly and billed solely on the basis of readings from Bailey Meters.

No small share of the accuracy and reliability of Bailey Meters is due to the conservative engineering policy of the Company. New ideas and designs are not offered for sale until they have been thoroughly tested both in the laboratory and in actual service.

Bailey Meters, Recorders and Controllers present a thoroughly modern yet conservative appearance.

Write for your copy of Bulletins No. 301 and 302, describing Bailey Fluid Meters for steam, liquids, gases, sewage, sludge, and compressed air.

MU-16

BAILEY METER • COMPANY •
1072 Ivanhoe Road, Cleveland, Ohio
BAILEY METER COMPANY LTD., MONTREAL

WITH THE MANUFACTURERS

National Meter Looks Back 70 Years

● The National Meter Co. is celebrating its 70th anniversary this year.

In a summary of accomplishments it can look back over its three score and ten years of meter manufacture with some pride. This Company was founded by John C. Kelly, Sr., in 1870—Mr. Kelly being generally considered to have been the "Father of the Water Meter Industry," in America at least. He and his associates did not have any too smooth going in those days of selling metering, but, they were of the hardy pioneer stock, and that they succeeded is evidenced by the record of National's 70 years of progressive production.

If one takes a look at the record, as it stands, some of the high spots stand out to warrant recording here and to justify the pride of those who have had a part in such progress, and in developments of basic importance to the industry as a whole.

To begin the story: It took real "guts" for a new company back in 1870 to accept an order for a 6" meter as its very first job. They named it "The Gem" and 6 years later a 10" Gem took first prize in the Philadelphia Centennial Exposition, for its size (largest meter yet produced at the time) and general excellence.

Three years later (1879) "The Crown" —a positive displacement rotary piston meter—was produced. Interestingly, these meters were manufactured with enclosed intermediates, and its superior performance and service did much to advance metering.

Then in 1884 another advance—the development of "The Empire," the meter which soon became recognized for its great accuracy. It was also a positive displacement piston type meter, produced in all sizes from ⅝" to 6" and still National's banner meter.

After another five years (1889), National's Chief Engineer, Lewis H. Nash, produced what is said to be the original disc-type meter, which he patented and named "The Nash." That "The Nash" continues to be manufactured in essentially its original design, after 50 years. speaks well for invention and inventor—and the name Nash carries on.

In 1895, the patented Straight Reading Registers were introduced as an innovation by National. Considered a startling improvement a wide demand was created, which has not yet ceased growing. (It is now understood that all meter manufacturers now supply straight reading registers where specified.—Ed.)

In 1909 National's records cite another "first"—a Compound Meter employing a control valve to keep the small displacement Empire meter operating while the heavy flows automatically passed through the velocity type Crown meter. This combination is still produced in sizes from 2" to 12".

Then in 1917, some 38 years since its early "Crown" was produced with enclosed intermediates, National began manufacture of oil-enclosed intermediates, now considered by many to represent an important and decidedly advantageous meter improvement.

Since 1918 National's records indicate continuing meter improvements, such as increased interchangeability of parts, improved materials and higher precision in manufacture.

We must say that National has an extremely interesting story to relate covering the period between receipt of its first consternation producing order of a 6" meter some 70 years ago, and its grand tally of better than 2,500,000 meters to its credit at the beginning of 1940.

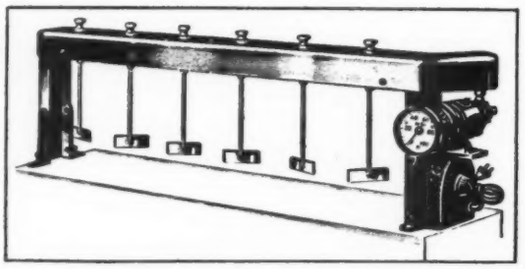
In procession pass National's prize winning "Gem"; "The Crown," with its historic enclosed intermediate; the high accuracy achieving "Empire"; The "Nash," the trail blazer of disc-meters; the pioneering Straight Reading Registers; the "big sister-little brother" Compound Meter—all to make metering history, and an outstanding record of National's achievements since 1870.

GOOD MIXERS . . .

in the

WATER WORKS FIELD

"Bob" Haywood of Industrial Chemical Sales—"Fred" Stuart, President, Activated Alum Corp.



THE *Phipps & Bird* LABORATORY MIXER...

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of this mixer—dry feed machines adjusted accordingly.

The Phipps & Bird Laboratory Mixer makes longer filter runs possible, together with reducing wash water consumption. All alert Water Works Superintendents and Chemists should "tie" in this Mixer with modern plant practice.

Send for Literature

PHIPPS & BIRD, INC.

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"SOUTHERN CENTER FOR LABORATORY APPARATUS AND CHEMICALS"

WANTED—SALES REPRESENTATIVES

An old, well established company manufacturing Water Treating, Filtration, and Sewage Disposal Equipment is seeking additional representatives in all territories in the U. S. State age, experience, previous connections, and other accounts. Address Box 201, Water Works & Sewerage, 330 So. Wells St., Chicago, Ill.

Experienced Travelers Say!-

IN ST. LOUIS STAY AT Hotel Lennox DOWNTOWN, GOOD PARKING GOOD FOOD AND REAL SERVICE

ALL ROOMS WITH BATH—RADIO RECEPTION

FILTER CLOTHS

COTTON—WOOL

ACID PROOF FABRICS

To Fit All Types of Rotary Filters

Write for Samples

William W. Stanley Co. Inc.

401 Broadway New York City

Prevent wear and cutting of rods, plungers, shafts and valve stems by using

MABBS RAWHIDE PACKING

In Your Water Works and Sewage Plants

IT LASTS LONGER — *Is Anti-Frictional, Saves Power, Labor and Repairs. Will prove the cheapest packing that can be bought.*

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Incorporated 1892

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The Meter-Master

RATE RECORDER FOR WATER METERS

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ARROWHEAD Grating and Treads

Engineers' Handbook sent on request

ARROWHEAD IRON WORKS

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... think of

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ACTIVATED ALUM CORPORATION

Curtis Bay Baltimore, Maryland

$5,000,000 in Dividends

(Result Largely from Research)

● In a statement made by Col. W. F. Rockwell, president of Pittsburgh-Equitable Meter Co., Chairman of the Board of Standard Steel Spring Company and several other companies, the year 1939 has been a highly profitable one to the companies he heads. Three of these, alone, have distributed $5,000,000 in dividends during 1939. According to the Colonel such profitable results can largely be ascribed to a consistent program of scientific research and development.

In this direction one of the outstanding developments by one of his companies is "Corronite," a metallic pore-free coating, which, even as extraordinarily thin coatings, offers exceptional advantages in resisting corrosion. The bond of Corronite to steel is so firm and its ductility so high that bending and forming does not impair its protective value. The following important companies have already been licensed to employ the Corronizing Process—Youngstown Sheet and Tube Co., Carnegie-Illinois Steel Corp., Republic Steel Corp.. and other large companies.

Another development to which Colonel Rockwell directed attention, is a series of plastic metallic lubricants for use at very high temperatures and pressures. This contribution presages the development of an entirely new industry.

R. F. Garcia Made Vice-Pres. Central Foundry Co.

● R. F. Garcia, General Sales Manager of The Central Foundry Co., producers of Universal C. I. Pipe and fittings, "Dual-Lok" Joint Pipe and 'Solus" Oil Separators for sewers, was on January 1st made a Vice-President of his Company.

CONSULTING ENGINEERS ATTENTION!

Be sure your Professional Card is included in the Consulting-Engineers-Directory a regular feature in

WATER WORKS & SEWERAGE

(See pages 76 and 77 this issue)

Send your card for insertion in next issue. Low rate includes monthly copy of magazine.

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WATER WORKS & SEWERAGE

330 South Wells Street

Chicago, Illinois

RUSTOP saves your tanks from costly corrosion

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RUSTOP, ***the cathodic system of corrosion prevention, reduces maintenance costs and prolongs the life of your tanks indefinitely.***

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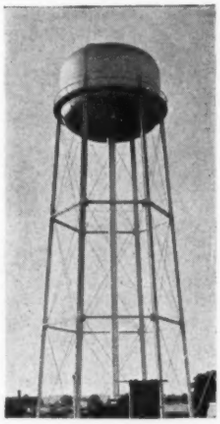

Entirely automatic; functions in cold or warm weather; protects tank and riser; old or new tanks without special preparation. Let us quote you on stopping rust in *your* tanks.

ELECTRO RUST-PROOFING COMPANY

3rd National Bldg. Dayton, Ohio

LEADITE

The Pioneer Self-Caulking Material for C. I. Pipe

TABLE OF COMPARATIVE QUANTITIES

Nominal inside dia. of pipe, in.	Depth of joint, inches of Leadite	Approx. lbs. of Leadite per joint	Depth of joint, inches of lead	Approx. lbs. of lead per joint
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

YOUR PROBLEM IS SCREENING SEWAGE or SHREDDING SCREENINGS

Sanitary engineers! Sewage plant operators! Anyone who is responsible for the efficient screening and disposal of municipal or industrial sewage should have a copy of this new book which describes Rex Mechanically Cleaned Bar Screens and Rex Triturators! Complete with detailed design data and application information, it is a valuable reference book to keep in your files.

Bulletin 319 also contains reprints of two articles written by experienced sanitary engineers. They describe in detail the benefits of using Rex Triturators and Rex Mechanically Cleaned Bar Screens in their plants.

Whether you're modernizing an old plant or building a new one, you need this fund of information close at hand. Send for your copy now! Address Sanitation Equipment Division, Chain Belt Company, 1610 W. Bruce St., Milwaukee, Wisconsin.

SEND FOR YOUR COPY OF THIS NEW BOOK!

REX CHAIN BELT COMPANY of Milwaukee

SANITATION EQUIPMENT

MEETINGS SCHEDULED

Jan. 17-19, 1940—New York City, N. Y. (Engineering Societies Building)
American Society Civil Engineers. Annual Meeting. Secretary, George T. Seabury, 33 West 39th St., New York City.
(Jan. 19—Sessions and Joint Dinner of the Sanitary Engineering Division and N. Y. State Sewage Works Ass'n.)

Jan. 19-20—New York City, N. Y. (Hotel McAlpin)
New York State Sewage Works Ass'n. Sec'y, A. S. Bedell, State Board of Health, Albany, N. Y.
(Jan. 19—Joint Annual Dinner with San. Eng. Div. of A.S.C.E.)
(Jan. 20—Joint inspection trip with San. Eng. Div. of A.S.C.E.)

Jan. 18—Boston, Mass. (Statler Hotel)
New England Water Works Ass'n. Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Jan. 22-26—Stillwater, Okla. (A. & M. College)
Oklahoma Water and Sewage Conference. Annual Meeting. Secretary H. J. Darcey, State Dept. of Health, Oklahoma City, Okla.

Feb. 7—New Brunswick, N. J.
New Jersey Section A.W.W.A. Sec.-Treas., C. B. Tygert, Box 178, Newark, N. J.

Feb. 19-23—College Station, Texas (A. & M. College)
Texas Water Works & Sewage Short School. Secretary, V. M. Ehlers, State Dept. of Health, Austin, Tex.

Mar. 4-8—Detroit, Mich.
American Society of Testing Materials. Sec.-Treas., C. L. Warwick, 260 So. Broad Street, Philadelphia, Pa.

Mar. 18-20—Birmingham, Ala. (Thomas Jefferson Hotel)
Southeastern Section A.W.W.A. Sec.-Treas., B. P. Rice, Room 425, State Office Bldg., Columbia, S. C.

Mar. 20-22—Trenton, N. J. (Hotel Stacey Trent)
New Jersey Sewage Works Association, (Silver Anniversary). Sec.-Treas., Paul Molitor, Jr., P. O. Box 374, Morristown, N. J.

Mar. 27-29—(Place not selected)
Canadian Section A.W.W.A. Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

*Apr. 4-5—West Lafayette, Ind. (Purdue University)
Indiana Section A.W.W.A. Secretary, H. G. Horstman, 603 Traction Bldg., Indianapolis, Ind.

Apr. 5-6—Miles City, Mont. (New Milligan Hotel)
Montana Section A.W.W.A. Secretary, H. B. Foote, State Board of Health, Helena, Mont.

Apr. 8-9—Santa Catalina Island, Calif.
California Sewage Works Association. Secretary, Wm. T. Ingram, Box 111, Stockton, Calif.

Apr. 15-17—Fayetteville, Ark. (Engineering Hall, Univ. of Arkansas)
Arkansas Water & Sewage Conference. Secretary, Harrison Hale, 114 Chemist Bldg., Fayetteville, Ark.

Apr. 21-25—Kansas City, Mo. (Headquarters Hotels—The Phillips, The President and The Muehlebach)
American Water Works Association Annual Convention. Secretary, Harry E. Jordan, 22 East 40th St., New York City, N. Y.

May 8—Portland, Ore. (Portland Hotel)
Pacific Northwest Sewage Works Ass'n. (Annual Meeting) Sec.-Treas. Fred Merryfield, Oregon State College, Corvallis.

May 9-11—Portland, Ore. (Portland Hotel)
Pacific Northwest Section A.W.W.A. Secretary, Fred Merryfield, Oregon State College, Corvallis, Oregon.

May 9-10—Akron, Ohio
Ohio Section A.W.W.A. Secretary, T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

May 16-17—Salisbury, Md. (Wicomico Hotel)
Maryland-Delaware Water & Sewerage Associations. Secretary, A. W. Blohm, 2411 North Charles St., Baltimore, Md.

May 16-18—(Place not selected)
Florida Section A.W.W.A. Secretary, A. P. Black, University of Florida, Gainesville, Fla.

*NOTE: Change in dates.

May 22-24—CHICAGO, ILL. (Congress Hotel)
Illinois Section A.W.W.A. Secretary, H. E. Hudson, Jr., 6843 Oglesby Ave., Chicago, Ill.

May 16-17—SALISBURY, MD. (Wicomico Hotel)
Maryland-Delaware Water & Sewerage Association. Secretary, A. W. Blohm, 2411 Corth Charles St., Baltimore, Md.

June 6-7—ITHACA, N. Y. (Hotel Ithaca)
New York Section A.W.W.A. (Spring Meeting). Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

June 24-28—ATLANTIC CITY, N. J.
American Society of Testing Materials (Annual Meeting). Sec.-Treas., C. L. Warwick, 260 So. Broad St., Philadelphia, Pa.

June 24-26—STATE COLLEGE, PA. (Nittany Lion Inn & Dormitories)
Pennsylvania Water Works Operators' Association. Annual Convention. Sec.-Treas., I. M. Glace, Consulting Engineer, 22 So. 22nd St., Harrisburg, Pa.

June 26-28—STATE COLLEGE, PA. (Nittany Lion Inn & Dormitories)
Pennsylvania Sewage Works Association. Sec.-Treas., L. D. Matter, Distr. Engr., Kirby Health Center, Wilkes Barre, Pa.

Sept. 24-27—NEW YORK, N. Y. (Commodore Hotel)
New England Water Works Association. (59th Annual Convention). Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 26-27—WILMINGTON, DEL.
Four States Section A.W.W.A. Secy.-Treas., Carl A. Hechmer, Washington Suburban Sanitary District, Hyattsville, Md.

LITERATURE AND CATALOGS

"Graver Equipment"—unfolds before the readers' eyes in an effective manner of presentation in a new bulletin by Graver Tank and Mfg. Co. of East Chicago, Indiana, boasting "77 Years of Dependable Service" in all forms of steel plate construction. It tells of Graver shop facilities and modern fabricating methods employed in producing the many items illustrated on the pages that follow. About 80% of such equipment is of interest to readers of WATER WORKS AND SEWERAGE—amongst such are Gas Holders (gravity and pressure types); Storage Bins and Tanks (of a variety of patterns); Floating Covers for Sludge Digesters; Standpipes and Stacks, Dust Collectors; Pressure Filters and Zeolite Softeners; Mixing and Rotary Meter Operated Proportional Chemical Feeders. An interesting full page line drawing pictures The Seip Multi-Tray Clarifier equipped with revolving tray scraping mechanisms and up-flow of treated liquid through descending floc or precipitate. For a copy of Graver's new Water and Sewage Bulletin, write Graver Tank and Mfg. Co., Inc., East Chicago, Indiana.

"REX Slo-Mixers"—is the mixing and flocculating mechanism introduced recently by Chain Belt Company of Milwaukee, which was subject of a descriptive announcement in the Equipment News Section of this magazine a month or two ago. A bulletin has now been issued which presents drawings, structural details and specifications covering the REX Slo-Mixers for multi-stage (rapid and thin decelerated) mix and flocculation. The equipment is "tailor made" for new plants or for installing in basins of existing plants. The "Slo-Mixer" is offered under the Langelier patents covering multi-stage coagulation, involving mechanical mixing. For a copy of Bulletin 379 write Chain Belt Co., Sanitary Engineering Div., Milwaukee, Wisc.

(*Continued*)

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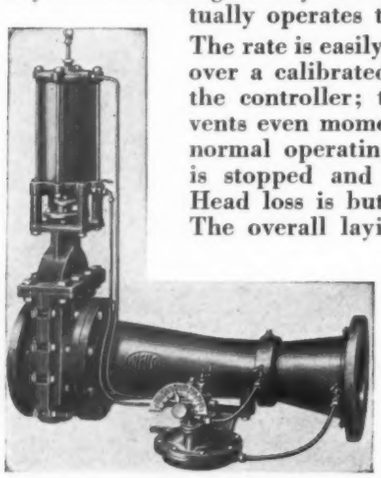

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"A Strikingly Handsome Calendar"—has come to us from W. H. and L. D. Betz, Consulting Chemical Engineers of Philadelphia. It is not usual that we comment on calendars in this column; however, this one deserves some special note because its theme from January through December is "Water". In January and February the purest of pure water appears in remarkable snow scenes and from then through December the land and water-scapes continuously change with the seasons until again December is another snow scene—all taken by expert photographers who know how. The charm of the calendar is its reflection of purity and the inconspicuous name strip of the firm. For 10 cents in stamps, to cover handling charges and postage, one of these calendars may be had by our readers as long as the supply lasts. If interested, address the W. H. and L. D. Betz Laboratories, 235 W. Wyoming Ave., Philadelphia, Penna.

"Locating Leaks, Pipe Lines, Valve Boxes, etc."—is the subject of a new bulletin describing the "Universal" method and equipment offered by Water Leak Detector Co. for tracing down difficult-to-find water leaks and locating pipe lines, valve boxes, services—and, most difficult of all, the location of short stub ends. These new bulletins present a picturized story in a few words that should interest every water utility head. The original "Universal" equipment has been simplified and the manufacturer offers to convince by arranged demonstrations on difficult jobs. A companion leaflet describes the compact wireless type of "Universal" Pipe Locator (Type T-R) in a very frank style—telling when and why the T-R Locator will not work and, on the other hand, where it is particularly effective with accuracy guaranteed through 12 ft. earth coverage, even on those difficult short stub ends. For further information or a demonstration, write Water Leak Detector Company, 116 N. Third St., Columbus, Ohio.

"Aerators" by International Filter, are presented in a new bulletin which discusses the functions of aeration and describes and illustrates the various types of International aerating equipment.

The bulletin points out the benefits of aeration in removing odors and adding oxygen. Removing carbon dioxide, and the resulting increase in the pH of the water is helpful in corrosion control and reduces the chemical cost if lime or soda-ash are subsequently employed. To remove hydrogen sulfide from waters aeration has two actions. It bodily sweeps out part of the dissolved gases and removes the remaining portion through oxidation. The several styles of aerators described in the bulletin include Forced Draft, Coke Tray, Multi-Cone, Spray and Cascade types. Useful information is given on the construction, operation and application of each type. For "Aerators" (Bul. No. 100) write International Filter Co., 325 W. 25th Place, Chicago, Ill.

"Paracoil—Waste Heat Boilers"—are of interest to readers of this magazine as a heat recovery unit in connection with gas engine operation at sewage treatment plants or in conjunction with incineration practice. They also serve as effective silencers when placed in the exhaust of Diesel or gas engines, and recover 70% or better of the heat produced by such units. In a new bulletin from Davis Engineering Co., of Elizabeth, N. J., their "Paracoil" heat recovery units are described and illustrated with especial reference to their adaptation at sewage treatment plants. Installations are listed and a typical "Paracoil" system is sketched—including

the important "Paracoil" 3-Way Swing Valve. Tables give requisite data for planning and estimating purposes. Other "Paracoil" units include Engine Jacket Water Cooler and Lubricating Oil Cooler. For "Paracoil" Bulletin 301, write Davis Engineering Corp., Elizabeth, N. J.

"Elastic Stop Nuts"—those highly serviceable nuts, with a self-locking patented feature, are about as effectively presented as could be imagined in a 56-page 1939 Catalog and Data Book from Electric Stop Nut Corp. of Elizabeth, N. J. The catalog graphically pictures the method of use and applications of these ingenious nuts, which have a resilient inset (collar) of a plastic base material. As the nut turns up the collar is squeezed and under such high compression eliminates all thread play, thus locking the nut in whatever position it is left. Use of these tenacious nuts eliminates the need for lock washers, cotter pins, etc., commonly used to prevent the working off of nuts as the result of vibration. That they may be re-used with equal results is interesting also. The catalog lists literally thousands of standard nuts and reveal typical applications, including locking of impellers to pump shafts, bolting of gas and Diesel engines, etc. For a copy of the 1939 Stop Nut Catalog write Elastic Stop Nut Corp., 1015 Newark Ave., Elizabeth, N. J.

"Automatic Boiler Service Units" are the subject of a new Bulletin from Roots-Connersville Blower Corp. The condensate units classify into three types: straight condensate return, boiler make-up and condensate return, and direct boiler feed. All units are priced complete with motors and controls, and are fully automatic in operation. These units cover a range up to 500 boiler horse power, and pressures up to 125 lbs., handling water not exceeding 210° Fahr. They are available with either vertical or horizontal tanks. On the horizontal tanks, structural steel supports provide varying elevations to meet the particular installations involved. The heart of these units is the well known R-C Turbine pump with V-shaped vanes. For Bulletin 260—B-143 write Roots-Connersville, Connersville, Indiana.

METERS—Steam, Liquid, Gas.—are presented in a 47-page illustrated bulletin just published by the Foxboro Company. The booklet contains an interesting discussion of flow problems and methods of approach to these problems. In addition to a complete description of remote measurement and flow control, data is provided on universal flow meters, pressure compensating meters, bell-type meters, wide-range meter settings, high pressure meters, square root integrators and indicating flow meters. Construction details include a diagrammatic presentation of the operation of the segmental lever and float, and information concerning automatic check valves, pressure-tight bearings, damping plugs, static pressure movements and electric and spring-wound clocks. Standard ranges are shown, and useful data is given on piping layouts and meter mountings. A section is also devoted to meter accessories. Copies of bulletin No. 200-4, may be obtained by writing The Foxboro Company, Foxboro, Mass.

"The Inside Story" tells more by picture than by word what's underneath the bonnets of Jenkins 125 lb. iron valves. It's a miniature booklet which really tells the "Inside Story" by photographic presentation of Regrinding Globe Valves; Regrinding Swing Checks; Double-Faced (wedge type) Disc Valves in sizes from 2 to 16 inch, of all iron construction at no extra cost. For Form 183 write Jenkins Bros., 80 White St., New York City.

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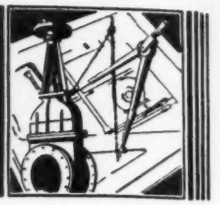

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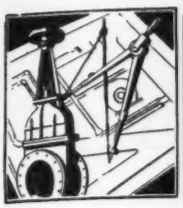

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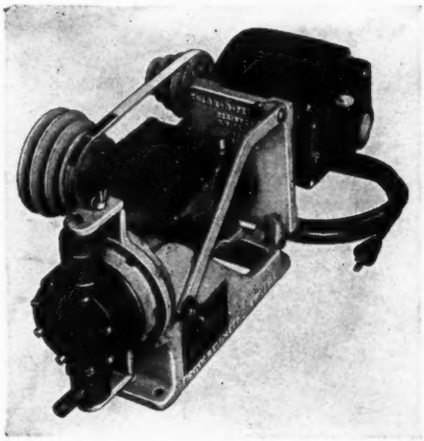

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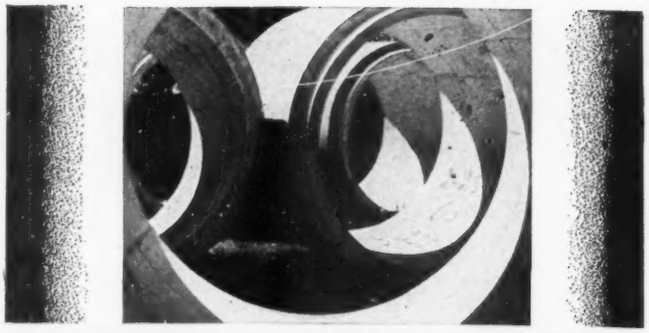

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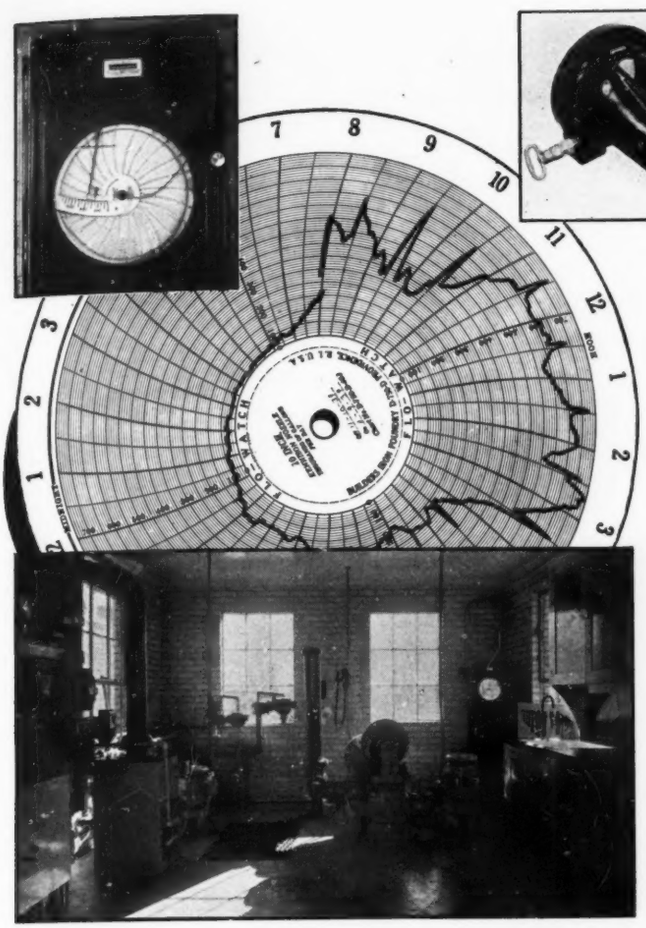

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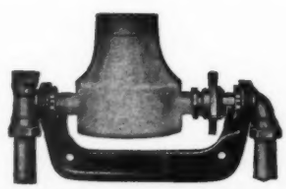


FORD METER BOX CO.
WABASH, INDIANA

Dorrco Doings in 1939

This year the disastrous but unadmitted wars of the recent past have flamed out into a major war whose end no one can see. When forces that believe themselves irresistible finally meet bodies determined to be immovable, one cannot foretell the ultimate culmination of events.

I wonder why it must take such tremendous sacrifices as war entails to teach the truth brought out in Staley's "World Economy in Transition" that political developments in recent years have been dead against the trend of technological progress and may prevent the world sharing in the great productivity modern research has made possible. Is it not possible that international acceptance last Spring of Streit's idea in "Union Now" might have prevented the present catastrophy?

Perhaps the time has come, as advocated editorially by Fortune last month, for the people of the United States to choose between three policies: retreat, isolation and international leadership. Retreat and isolation might easily lead to that very totalitarianism that we fear, yet which characterizes every state that has attempted national self-sufficiency. International leadership involves not merely passive assistance in the formulation of an entirely new order of peace but the making of definite national commitments and sacrifices to this end.

WESTPORT MILL

"Micronsizing," the technique of handling and separating ultra-fine particles in the 3 to 10 micron (5000-1500 mesh) range, has actively engaged the attention of our laboratory staff this year. A new type of Classifier has been developed for making coarse separations in the 4 to 28 mesh range — at the other extreme of particle size. This year has seen an all-time peak in research and development projects in progress.

AUTOMATIC RAKE LIFTING

Automatic, power-operated lifting devices on Classifier and Thickener rakes have given a good account of themselves and will shortly be offered commercially. Both aim to eliminate a tedious manual job and the human equation.

FEDERAL RECLAMATION PROJECTS

High specification concrete sand for the Shasta Dam will be prepared in our Classifiers along the same lines as at the Boulder and the Grand Coulee Dams. A small 50-ton an hour sand preparation plant in the East has shown that these same methods of sand fractionation and blending can be applied economically on a small scale.

FX'S FOR CHINO

Our 8 ft. wide, heavy duty FX Classifiers have been installed at Chino Mines of Nevada Consolidated to modernize the primary fine grinding units. Grinding is to 14 mesh with pulp elevated by our new Sand Wheels.

PICKET THICKENERS AND CLARIFIERS

Our new picket sedimentation units have demonstrated denser sludge discharges than heretofore possible. The novel underlying principle should be applicable in many industries.

INDUSTRIAL WATER PURIFICATION

We have supplied several plants this year for removing color and turbidity from process water. Chemical mixing, flocculation and sedimentation are all tied together in a single compact structure.

SUGAR

Petree & Dorr, Engineers, Inc., specialists in cane sugar processing, now handle Oliver Cachaza filters in most of the world outside of the United States and the West Indies. The new Multifeed Clarifier has demonstrated substantial increases in capacity and juice clarity. During the next campaigns many machines will be operating in 10 different countries.

MUNICIPAL SANITATION

Our Clariflocculator has been broadly accepted in this, its first year, and is yielding 70-75 percent removals of suspended solids against 50-55 for Clarifiers alone.

Our new Biofiltration System gives uniform final effluents, regardless of feed fluctuations. Results are comparable with Chemical Precipitation and Activated Sludge Treatment.

The 100 M. G. D. water softening plant of the Metropolitan Water District of Los Angeles is being equipped with Flocculators and two 200 ft. Squarex Clarifiers.

ABROAD

Two complete new cyanide mills in the Balkans started up this year and construction neared completion on the first 52 M.G.D. section of the Paris, sewage treatment plant, equipped with our Clarifiers and Digesters. In England we have equipped one of the largest alumina plants for red and white mud handling.

West Africa and Manchukuo have taken a large amount of milling equipment, including a shipment requiring a complete 13 car train. Penha, Brazil, a suburb of Rio de Janeiro, is building a complete Dorr sewage plant, and we are equipping a new water purification plant in Colombia.

A quick trip to Europe just before the outbreak of hostilities and an even shorter one to Eastern Canada were my only breaks away from home this year. The dislocations of war to our European associates have been severe but work continues in nearly every area.

To our friends everywhere I send Christmas greetings from all of us of the Dorr family and express our fervent hope that unsettled world conditions will clear and give all a Happy 1940.

John V. N. Dorr

570 Lexington Ave., New York

DORRCO

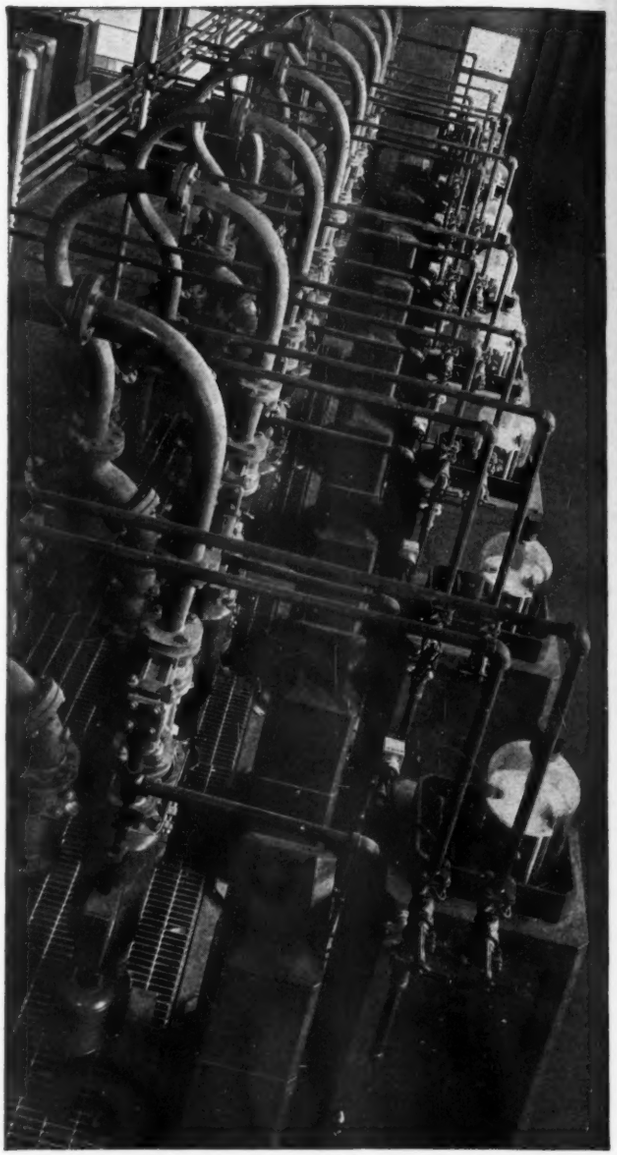
DETROIT CHOOSES W&T

for World's Largest Chlorinator Installation

Cleveland, Buffalo, St. Paul-Minneapolis, Tallman's Island, N. Y. C.— every outstanding Sewage Disposal project completed in recent months is equipped with W&T Visible Vacuum Chlorinators.

W & T is proud of this fact — but prouder still of the sixteen thousand smaller installations that have marked twenty-five years of determination to provide the dependable, accurate control apparatus demanded by the exacting work of Public Health Protection.

No matter how large or how small your chlorination project may be, W & T equipment will meet every requirement. Each unit —each installation — is backed by a nation-wide field organization whose sole responsibility is the satisfactory performance of W & T equipment.



Nine—6000 pound per day Visible Vacuum Chlorinators will feed 27 tons of chlorine daily at Detroit's new Municipal Sewage Treatment Plant.

WALLACE & TIERNAN CO., Inc.

Manufacturers of Chlorine and Ammonia Control Apparatus

NEWARK, NEW JERSEY, Branches in Principal Cities...Main Factory, Belleville, N. J.